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ABSTRACT

The Green Thumb Project was designed to test the feasibility of operating a computerized system for disseminating weather, market, and other agricultural production and management information on a day-to-day basis; to develop a prototype software support system for the test; and to provide essential project information on conduct of the test to enable the evaluation agencies to evaluate the usefulness and acceptability of the information and its dissemination system. Included among the project activities were the following: a review of systems similar to Green Thumb; administration of a baseline survey to 172 Green Thumb users to collect data concerning their background, farm operation, and orientation toward the use of weather and market information; interviews of extension personnel concerning the usefulness of the Green Thumb system; and maintenance of time logs of extension personnel to verify the time they spent on the Green Thumb system. Analysis of these data indicates that the Green Thumb system is reasonably successful and that the overall design of the system is workable. Recommendations were made concerning improvement of computer design problems, aggregate usage, project administration, and project staffing. (MN)

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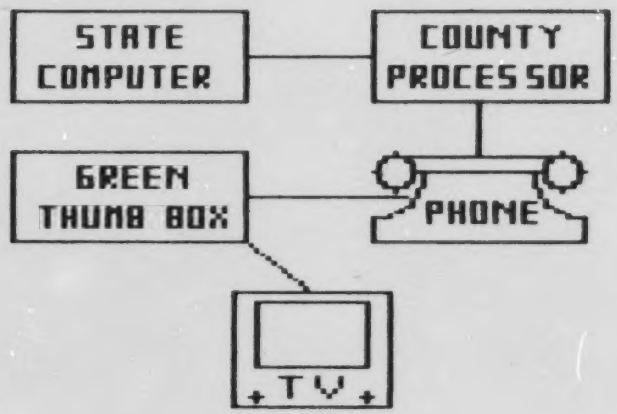
AN EVALUATION OF A COMPUTER-BASED VIDEOTEXT INFORMATION DELIVERY SYSTEM FOR FARMERS:

THE GREEN THUMB PROJECT



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I

GREEN THUMB - ITS INITIATION

Advances in communications and computer technology are making possible new communication delivery systems in which information is computer-based, transmitted over common-carrier telephone lines, and displayed on home television receivers. Such systems are dependent upon advances in computer design, computer networks, data storage, transmission technology and visual display; however, the interlinkage of these components has provided the key to making these databases readily accessible to large numbers of users.

Two main approaches to home information systems are generally referred to as Teletext and Videotext. Teletext is essentially a one-way broadcast information system over the air or via cable with the information displayed on a specially equipped television set. Videotext systems also display the information on a home television receiver but are made interactive by a telephone link of the user with computer-stored data banks. Both systems offer the user access to large information banks stored in central computers and displayed as a still image on the users TV receiver; however, with videotext the user has control over what information is received.

European countries are well ahead of the U.S. in the use of this technology (Jones, 1979, and Zimmerman, 1979). The British Broadcast Corporation began experimenting with a teletext system in the early 1970s and by 1980 was reaching about 40,000 households. They broadcast about 700 pages of information on such topics as news headlines, weather, market reports, sports, consumer news, and educational guides. In addition, the British Post Office

is testing a telephone-based videotex system called Prestel in 700 businesses and 850 homes. Approximately 160 different information providers are maintaining the database that includes a very wide range of subjects and information guides, with the British Open University being one of the initial information providers. Trials of similar systems are planned for Finland, France, Spain, Sweden, and the Federal Republic of Germany. Canada has entered into a trial of a videotext system called Telidon. It is a public-accessed, interactive retrieval system that displays the message on modified television receivers. Similar systems that draw upon the British and Canadian experiences are now being experimented with in the U.S. A prime example is the Viewtron test by Knight-Ridder in Coral Gables, Florida.

The use of computers in agriculture is expanding rapidly, though few past experiences resemble a videotext-type information delivery system. Most have been developed primarily for purposes of record keeping and analysis of farm operations (Examples are TELPLAN at Michigan State University, AGNET at the University of Nebraska, FACTS at Purdue University, and CMN at Virginia Polytechnic Institute and State University).

Green Thumb (GT) is an example of a videotext system but differs in some respects from other systems. Green Thumb has a computer-maintained database that depends upon a network of computers for receiving and delivering information. It is targeted to a particular audience with specialized needs (farmers) rather than the general public. Though users make specific requests for the information they desire, it is a limited interactive system. In a single telephone call, the user requests specific information, the requested information is transmitted, and the telephone connection is then broken. Subsequent requests require initiating another telephone call. Green Thumb is dependent upon a receiving unit (referred to as the

Green Thumb Box) attached to the users standard TV set. This user terminal holds the information in memory and displays it as a visual message on the TV screen.

After observing Green Thumb, many Extension Services and agri-business organizations indicate that they are planning systems of computerized agricultural information for farmers. Professional Farmers of America began operations in March 1981 of a weather and market information system called "Instant Update." User cost for the service is $90 per month, plus the long distance telephone changes for each call to Cedar Falls, Iowa.

The Elanco Products Division of Eli Lilly Corporation is providing terminals to farmers in the West and Southeast who have purchased 250 gallons of Treflan in the last year. Called "Agrivision," this program uses part of the Professional Farmers of America database, with Elanco paying usage charges and farmers paying the long distance phone calls.

Some of the systems in the planning stages are the following: The Baltimore Farm Credit Banks have agreed to purchase state computers for the Cooperative Extension Services in each of its five state service areas. The Southern States Farm Supply Cooperative wishes to make a computerized information service available to its membership either in cooperation with the Cooperative Extension Services, or directly from Southern States. The National Farm Bureau Board has also recommended the adoption of a GT-type system for its membership.

A. Genesis of the Green Thumb Project*

According to several sources, the Green Thumb Box idea was conceived by Howard Lehnert of the U.S. Department of Agriculture and

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* Adapted from the Stanford Report for purposes of consistancy.

Harold Scott of the National Weather Service as a means of providing better weather information service to farmers. Scott had pioneered the all-weather FM radio stations for National Oceanic and Atmospheric Administration (NOAA). He was aware of the limitations of voice-only weather information (it is estimated that it would take two and a half hours to cycle through all the weather information that would be potentially relevant to farmers in one locale; however, a single farmer might be interested in only a few minutes of the information). When Scott observed some children playing electronic TV games, he remarked to Lehnert that a similar device might be used to visually convey weather information to farmers. Thus the idea behind Green Thumb was born.

This event occurred in 1975 or 1976. Both Lehnert and Scott, who today are referred to as the co-founders of Green Thumb, had background knowledge of electronics. For the next year or so, they explored alternative communication technologies for weather information delivery. They arrived at three criteria for an ideal system:

(1) The technology had to be relatively simple and inexpensive. This criterion led them to reject a full-keyboard terminal as well as statistical facilities for the user.

(2) The system had to be entirely in the public domain, so that fees would not be charged for the Green Thumb Boxes or for retrieved information.

(3) All of the components had to be American-made, to avoid compounding the balance-of-payments problem. This criterion was emphasized by Commerce Secretary Juanita Kreps when Lehnert and Scott demonstrated the Green Thumb idea to her.

Senator Huddleston of Kentucky learned of the Green Thumb idea in 1977. When Lehnert and Scott told him more about it, he was supportive but advised them to check out its technical feasibility. They contacted several private companies whose cooperation would be needed (e.g., AT&T) or whose equipment might be the nucleus of the Green Thumb Box (e.g., Tandy-Radio Shack). Senator Huddleston's legislative aide, William Seale began to work with Lehnert and Scott to locate funds for an experimental system.

Lehnert and Scott called their idea "AGWEX" to indicate its weather-information function. However, a secretary in Senator Huddleston's office referred to it as the "Green Thumb Box," and the name stuck.

By November 1977 the basic Green Thumb idea had taken definite shape. It would be an information system that would use a farmer's existing telephone and television set, with a low-cost storage unit (the Green Thumb Box) into which information from a nearby computer could be transferred. This "dump and disconnect" feature was an innovation intended to minimize phone-connection costs; it was a unique feature of the Green Thumb idea.

The Department of Agriculture appointed several committees to assess the technical feasibility of Green Thumb. Out of these assessments came the decision to include agricultural marketing information as well as weather information. Thus the USDA's Agricultural Marketing Service became involved, along with USDA's Science and Education Administration (SEA), which included agricultural extension and research. The Agricultural Marketing Service could

not provide all of the marketing information itself, and the decision was made to purchase frequently updated market statistics from a commercial source.

B. Project Objectives

Formal statements as to the purpose of GT are spelled out in Cooperative Agreement Number 12-05-300-411 between the Kentucky Cooperative Extension Service and the SEA-Extension USDA that became effective September 19, 1978. As stated in the Cooperative Agreement, the objectives of the Green Thumb project were:

(1) To test the feasibility of operating a computerized system for dissemination of weather, market, and other agricultural production and management information on a day-to-day basis,

(2) To develop a prototype software support system for the test, and

(3) To provide essential project information on conduct of the test to enable the evaluation agencies to evaluate the usefulness and acceptability of the information and the information dissemination system.

These general statements were then operationalized in the Plan of Work with the following phases:

(1) The development of specifications for hardware and software design,

(2) The acquisition of adequate hardware and software for a field test,

(3) A laboratory test of the system, and

(4) The operation of a 14-month test of the system in two Kentucky counties.

Though much of the discussion and attention surrounding the GT project, focused upon the farmers' use of the system, it should be kept in mind that more of the overall effort dealt with the development of the system than with its operation. Since previously there existed no such delivery system like GT more time was actually spent in the developmental phase than on the field test (18 months for development and 14 for the field test).

C. Budget

The original Cooperative Agreement provided that SEA-Extension, USDA would contribute $200,000, the National Weather Service, NOAA $100,000 and the Kentucky Cooperative Extension Service's match would be $254,348. Subsequently, an additional $200,000 was provided by SEA-Extension. Most of the contribution of the federal agency was for hardware and software acquisition, whereas Kentucky's portion was primarily in terms of personnel costs. Major items in the budget were the purchase of GT Boxes and county computers ($80,000), software and hardware development ($100,000), and technical support ($45,000).

D. Preexisting Conditions and Assumptions of Green Thumb

Many aspects of the Green Thumb Project were predetermined at the outset. Some of these were specified in the Cooperative Agreement and the Plan of Work, while others were communicated verbally. Still others were established by the very nature of the project, the time frame and resources available, and the state of technological development at the time.

1. State of the Technology

The Green Thumb System was conceptualized and designed at a time of rapid technological advancement in the development of computer-based information systems. As a result, this system, like many others, may be considered antequated even before they are field tested. The Green Thumb System was conceptualized in 1978 and 1979, thus it would be considered three to four years old today. Components that are readily available now, or will be soon, were either unavailable or too costly at that time. Green Thumb had to be assembled as components from different vendors because there was no single system available that would have performed the tasks required. In addition, hardware and software development has improved such aspects as memory capacity, text and graphics display, communication linkages, interactive capabilities, and computer networking. Even though a system like Green Thumb is outdated almost as soon as it is developed, it has played a key role in the early stages of the development of videotext systems. Though limited in scope, the Green Thumb test provides insight into the adequacy of the technology and system design.

2. Computer-Based System

Videotext is a technological hybrid that draws upon both the computer and communications industries. The ability to store large databases and then to retrieve them upon demand is dependent upon the use of computers, not just a single computer but a network of computers for receiving, storing, and distributing information. The Green Thumb system utilized a preexisting

state computer at the University of Kentucky, a county computer in each of the two county locations, and terminals in users' homes. In addition, weather and market information came from three computers outside of the U.K. system. Such a complex network requires adequate communications linkages, software development, hardware compatability, and management control.

3. Limited Interactive System

Videotext systems have interactive capabilities. This two-way communication allows the user to request the type of information desired rather than receiving all that is being broadcast. Generally, this feature allows for multiple messages in both directions in a single session. The Green Thumb system has limited interactive capability in that it allows the user to select only what is desired, but permits only one transaction per session. The user enters his/her requests and the desired information is transmitted to the user's terminal and stored in memory. The amount of information that can be received in a session is determined by the capacity of the memory. Another session has to be initiated to receive further information. This request, transmit and disconnect mode was decided upon by the federal agency. Though not allowing for full interactive capability, it minimizes telephone connect time and can be handled by computers with smaller capacity.

4. Specialized User Group

From the start, the project had as its purpose the provision of weather, market, and production agriculture information to farmers. An important aspect of the test is that some systems are being directed toward the mass market of the public at large; whereas,

this one was developed for a group with specialized needs. Green Thumb was targeted to the needs of the manager of an economic enterprise--the farm. This approach of directing a system toward a specific audience is referred to as narrowcasting (in contrast to broadcasting). It allows for more selectivity in information content and can be directed at the target audience. It is also more likely that such users would be willing to pay for such service (especially if it related to an economic enterprise) than would the public for general residential use.

5. Limited Test

Green Thumb was operated in one state with 200 users. This limitation was set by the funding agencies according to the resources available for the test. The limited scope of the project influenced the manufacture of hardware, software needs, the number and distribution of users, and the commitment of institutional members to the project. Future tests of a different magnitude may not experience these same constraints.

6. Telephone System

The Cooperative agreement clearly specified that the method of information transmission in the Green Thumb project would be by telephone. Other means could have been choosen--radio, satellite cable television, etc. Nevertheless, telephones have a high degree of penetration into most all homes of the U.S., even in rural areas. Therefore, it seemed like a logical choice. However, there will be differences of opinion about the capability of the telephone system to handle this increased load. A second concern in rural areas is the high proportion

of multi-user (party) lines. Only private phone users were included in the Green Thumb test. Does this mean that persons on party lines (often not at the person's choice) will not be able to participate in a videotext system if it is telephone based? This then raises questions of equity. And thirdly, does the use of videotext place an unacceptable overload on the individual user's home or business phone? These issues will need to be addressed in future systems.

7. Utilization of Existing Systems

It was generally agreed from the start that this new information system would be developed within the institutional structure of the Cooperative Extension Service and would utilize, to the extent possible, existing information sources. A new institutional structure was not created, but rather the project was "piggybacked" on a preexisting agency. This has the advantage of being able to draw upon many resources that are unavailable in an independent operation. However, there are limitations to an organization that is not developed specifically to carry out the project. In addition, Green Thumb was to utilize existing information sources. Specifically, according to the Cooperative Agreement the Green Thumb project staff were not to make weather forecasts but were to utilize existing National Weather Service information, while the Agricultural Marketing Service and the Commodity Markets were the sources of market information.

II

EVALUATION PROCEDURES

A. Evaluation Strategy

In order that evaluation results of communication systems provide practical answers to questions concerning the future development of similar systems in other states, the evaluation strategy poses specific questions at each stage of program development. Useful program evaluation depends to a great extent on specifying the expectations in each of these stages. Thus, program evaluation is an integral part of all stages of the program development process. Four interrelated stages should be considered: (1) initiation, (2) preoperation, (3) program operation, and (4) program outcomes.

Program initiation is the first stage of program development and is concerned with translating an idea into a plan of action and with the acquisition of appropriate resources. It deals with obtaining adequate financial and physical resources and developing socio-political legitmacy for the effort. The planning process in this stage includes specifying measureable program objectives, selecting appropriate technology for attaining these objectives, and defining a target client population of individuals and organizational members.

The second stage considers preoperational concerns. It depends upon conditions of successful program initiation, but is concerned with the operationalization of an idea. In this stage the organization applies its resources and its management skills to the attainment of the objectives of the program. Also, it considers staffing procedures, material acquisition, budgetary allocations, and overall coordination of the project.

Program operation refers to the process of delivering the content of the program to the program beneficiaries. Efforts to assess program operations

generally focus upon the management plan for the delivery of services, the system performance, and organizational impacts. These indicators of successful attainment of program operation are necessary gauges of the activity level of the effort, but they do not, in themselves, insure outcomes.

The measurement of program outcomes or impacts is the final stage. It provides an indication of the extent to which program objectives have been reached. This stage is concerned not only with anticipated benefits but also with the unanticipated (and perhaps undesirable) consequences of the program.

The first three stages focus on the formative or developmental aspects of evaluation. The Kentucky portion of the evaluation will deal with those aspects and Stanford University will examine the outcome or impact on users. The following outline presents a concise format for considering the project's first three stages.

B. Evaluation Objectives

The Kentucky portion of the evaluation focused on the formative or developmental aspects of the project. It was concerned with the institutional system of the information provider and its operation, the technical adequacy of the hardware and software components of the system, and a description and analysis of the pattern of use* of information. This assessment provides information concerning the institutional, technical, and informational requirements of such a system that can then be used by project managers in the improvement of its design and functioning. These functions had the following purposes:

1. To analyze the types of information being requested by the different types of clientele being served.
2. To provide information into the institutional concerns as Kentucky and other states consider the adoption or expansion of the Green Thumb concept.

*The term use refers merely to the act of requesting information and is not meant to include the process of utilization of that information in decision making.

3. To provide an assessment of the technical adequacy of the system.

Originally, the major purpose of the evaluation study was to assist policy makers in deciding whether to proceed with the support for an expansion of GT-type systems in agriculture. However, since many states are going ahead before this evaluation is complete, it will prove more useful if the evaluation focuses on the question of "how" to implement such a system, rather than "whether" to implement. Experiences from the GT test will then assist individuals improve the design of future systems.

C. Data Sources

This section provides a description of the various sources of information that comprise the database for the study. They range from the observations of the authors over the life of the test to formal interviews with information providers and administrators.

1. Literature Review

A review of systems similar to GT was undertaken at the outset. This information provided a basis for many of the issues brought up and discussed throughout this report. In addition to the traditional means of surveying the available literature, other ideas were generated from industry and agency representatives in personal conversations.

2. Baseline Survey

In order to secure background information on the GT participants, a baseline survey was carried out at the start of the test period. This questionnaire focused on the characteristics of the farm operation, background variables on the farmer and his family, and the farmer's orientation toward the use of weather and market information (Appendix A).

Information was obtained from 172 of the GT users. The remainder failed to return the form after repeated followups. Fifty-five of the 172 responded after the beginning of the test. However, inasmuch as

this instrument provided background characteristics (i.e., farm size) on the users, this information would not be expected to change substantially during the data collection period. Additionally, information on the nonrespondants was provided by the Stanford study.

3. Computer-Monitored Usage

An important information source over the life of the test was the usage information on each request. This was processed and compiled by the county computer and then transmitted to the state computer. It recorded the user identification number, the type of information requested, the information received, the month, day, and time of the request, and the length of time of the transmission. These data were gathered for the 13-month period. Such information was then aggregated for the total group of users, for users in each county, and for purposes of examining changes in usage over time. In addition, individual farmer usage was examined in order to draw conclusions about the usefulness of GT for different type farmers.

4. Interviews of Extension Personnel

In order to secure sufficient information on the information provider system, interviews were conducted with key Extension specialists, agents, administrators and staff. A total of 17 specialists, 2 county agents, 5 administrators, and 5 staff members were interviewed.

Data on the provider system were collected through personal interviews using a semi-structured schedule (Appendix B). These interviews were conducted during the period from July 29, 1981 to September 11, 1981. Each interview took anywhere from an hour and a half to three hours to finish. They focused on the organization of data entry tasks, the perceived usefulness of GT-type system in the delivery of Extension information, the time commitment required, and future potential for such a system for different subject-matter areas.

5. Time Logs of Extension Personnel

In addition to direct questioning of GT participants on the amount of time they spent on GT, Extension also has a time reporting system (Kentucky Extension Management Information System) in which all professional employees participate. This system provided information for substantiating the interview results.

D. Methods of Analysis

The data analysis utilized various techniques, from descriptive through multivariate analysis.

1. Descriptive Analysis

Because of the exploratory nature of the GT project, an important part of the evaluation was based on observation, open-ended responses, perception, and projections into the future. Much of this information lent itself to descriptive and interpretative reporting rather than quantitative analysis. Some of the more general recommendations came from these data sources.

2. Univariate Analysis

Frequences and distributions on a single variable provided important findings. Such indicators as frequency of use of different types of information and the proportion of information items that are entered automatically are excellent examples.

3. Bivariate Analysis

An important next aspect of data analysis was the cross-tabular presentation of two variables. It was then possible to address another series of research questions. For example, how is use of GT related to farm type? This method also included analysis of longitudinal data.

4. Multivariate Analysis

Multivariate analysis was utilized in order to carry the analysis one step further. It was possible to control for certain conditions with this approach, but there were limitations because of the small sample size.

III

PREOPERATIONAL STAGE

The preoperational stage was concerned with the steps taken to implement the project and, therfore, covers the time period from when the Cooperative Agreement was signed on September 19, 1978, until the system began operating on March 3, 1980.

A. Coordinating and Operations Committees

In the formulation of the project it was decided that the GT system would be operated by the Cooperative Extension Service, and further it was agreed that it should be tested by a state Extension Service. Kentucky was then chosen as the test site. In the initial period following the signing of the Cooperative Agreement, two committees were formed to give direction to GT. At the federal level a GT Steering Committee with representatives from SEA/Extension, U.S. Department of Commerce, National Weather Service/ NOAA, Office of Management and Budget, the National Telecommunication and Information Administration (NTIA), Agricultural Marketing Service/USDA, Purdue University, and the University of Florida was constituted to give overall direction to the project. That group then appointed two subcommittees, one on evaluation and another to consider policy issues. The Evaluation Subcommittee was very active in the design and implementation of the evaluation.

In Kentucky an Operations Committee composed of persons from SEA/ USDA, Purdue University, NTIA, and the University of Kentucky was established for the purpose of developing technical design specifications.

Grumman Data Systems was later retained as a consultant to this group. The Associate Director of the Kentucky Cooperative Extension Service served as overall project director and Chairman of the Operations Committee. This committee was crucial to the translation of the GT concept into hardware and software specifications for the system, in presenting these ideas to industry representatives, in developing the request for proposals, in making the contract selections, and in conducting a design review of contractors plans.

In addition, a GT Coordinating Committee made up of representatives of the Departments of the College of Agriculture at the University of Kentucky gave direction to data inputting. An accompanying Advisory Committee with farmer representatives often met jointly with the staff group.

B. Acquisition of Equipment and Services

An important step in the development of a GT system was the specification of hardware and software needs and their acquisition. Since no pre-existing GT-type system was available for purchase, the components had to be developed in response to specifications that were developed by the Operations Committee. Though this proved to be an arduous process, it did result in a system that was custom made for the unique requirements of GT. This is unlikely to occur in future systems of this limited dimension.

Though it has been stated that considerable costs of research and development were incurred by the manufacturer of the GT Boxes, the cost of the boxes to the project was near the amount budgeted (about $200 per unit). Likewise the county computers were near budgeted figures. The two county computers were leased at a cost of $744 per month per county.

However, software development of $160,000, communication linkages, and personnel costs exceeded projections. These unanticipated expenses necessitated a supplemental allocation of about $200,000 from SEA-Extension. Green Thumb was also dependent upon a state computer at the College of Agriculture in Lexington. This was a preexisting unit that was provided at no cost to the project. Though some computer programming services were provided by personnel of the Agricultural Data Center of the College of Agriculture, it was decided that Center personnel lacked the time and expertise to develop the necessary GT software. Consequently, a private firm was employed for this purpose.

All contracts for the purchase of hardware and software were handled by the Purchasing Department of the University of Kentucky. In a public institution there exist regulations that pertain to the acquisition of equipment and services. These vary considerably by institution but generally each entails a bid process that requires accepting the lowest price on comparable merchandise. Though the UK Purchasing Department was very helpful, generally such purchasing departments have little or no experience in the acquisition of equipment for a videotext system. Consideration needs to be given such factors as the compatability of different components, cooperativeness of the vendor, future systems expansion, and the number of vendors.

C. Software Development and Testing

In addition to the internal software of each computer, the GT system required software for receiving, formatting, and storing information on the state computer, protocol for communication between the state and county computers, and protocol for transmission of data from the county computer to the state. Though the general functional specifications were

developed by the Operations Committee, Grumman Data Systems was retained to actually develop the software. The decision to have a contractor develop the software instead of hiring personnel to do so was made on the basis of time limitations and a lack of availability of qualified people for a short-term assignment. Therefore, the software was provided by Grumman as a deliverable much like the hardware.

A test of a simulated GT system was conducted by using the computer at Purdue University for the state computer. This laboratory test was to simulate field conditions in order to provide further information for the development of more specific software and hardware requirements. In addition, since Grumman developed a prototype system for demonstration at the industry conference and was the contractor for software development, further testing was carried out through the use of their computer.

D. Staffing

A new organizational structure was not created for the implementation of the GT project. Existing Extension Service personnel provided almost all of the professional staff support. Kentucky staff who were key to this pre-operational stage were the project director, an agricultural meteorologist, a marketing specialist, the Director of the Agricultural Data Center, an entomologist, and a rural sociologist. In addition, a GT coordinator was named in each of the subject matter departments of the College of Agriculture. The only staff hired specifically for GT was one full-time and several part-time workers in the Agricultural Weather Center and one agricultural economist (both professionals were at the Masters level). No additional personnel were added in the Agricultural Data Center, the Department of Public Information, or subject matter departments.

E. Sources of Information

Various sources of information provided the database for GT. Some of the information was external to Kentucky Extension and some internal, some was automatically updated and other manually entered. In all, about 450 different information items were included on the database.

Weather information was received from the NWS in various forms. NOAA gave permission for UK to be a drop point for the NAFAX circuit in order to receive weather maps, to receive two drops of the Kentucky Weather Wire for advisories (one into the computer and one for hard copies), to have access to the remote radar circuit for receiving radar maps from the Covington and Nashville stations, and to receive agricultural weather advisories from the NWS Regional Agricultural Weather Center at Purdue University. These connections necessitated the purchase or lease of weather facsimile equipment, radar facsimile equipment, two digitizers, a computer terminal, and two telephone lines. Approximately 30 weather items were maintained on the GT database, of which about half were updated automatically by computer and the other half were manually entered. However, the balance between automatic and manual updating as reported here is misleading because most of the items that are automatic are severe weather warnings which were infrequently used. Of the weather frames, 70 percent were text messages, 23% semi-graphics and 6% fine graphics. Three-fourths of the text messages were updated automatically. All maps were manually entered on digitizers.

Market information can be grouped into the following categories: futures prices, cash prices from the Agricultural Marketing Service, USDA reports and specialists' recommendations. An initial contract was made with the commodity boards concerning the possibility of securing futures markets directly from the boards. This option proved to be too costly,

so it was then decided to purchase the service from a private supplier. The futures prices were provided by contracting with American Quotations Service, AQS (later purchased by the Commodity News Service). AQS obtained these data from the Chicago Board of Trade and the Chicago Mercantile Exchange by computer, then formatted and transmitted them to the state computer in Kentucky by leased telephone line. Cash prices were obtained from the Agricultural Market Service leased wire system and from other USDA sources. State, regional, and national prices were provided by AMS at no cost to the project. AMS agreed to provide Kentucky with selected information items from the over 800 available on their leased wire network, reformat them, and transmit them to the GT state computer. This service was operational for a six-month period - from October 1980 until March 1981. USDA reports were obtained from news service wires and from the actual publications as they became available. Extension recommendations were written and entered manually by state specialists responsible for marketing. The number of marketing items totaled about 40, of which 80 percent were updated automatically.

The third major source of information was Extension specialists and agents. They entered advisories in agricultural production and management, home economics, 4-H/youth, and community development. These four program areas were supported by specialists in the following subject areas:

Agricultural Economics
Agricultural Engineering
Agronomy
Animal Sciences
Entomology
Forestry
4-H/Youth
Home Economics
Horticulture

Plant Diseases

Resource Development

Rural Sociology

In addition, County Agents entered information of interest at the county level. These included such things as upcoming meetings and more specific recommendations in the four program areas. All specialist and agent information was entered manually on terminals into the state computer. Approximately 380 information items were entered by this method.

F. County and Farmer Selection

The GT Project was tested by 200 Kentucky farm families, 100 in each of two counties. From 20 counties that expressed interest in receiving the project, site visits were made to five. With this information a committee of Extension specialists selected two that represented the variety of agriculture in the state (Todd and Shelby Counties). Todd County is dominated by corn, soybeans, and small grain production; whereas Shelby County depends heavily upon beef, dairy and tobacco.

Farmers in the two counties were then invited to indicate their interest in participating in the project by means of a mailing to all farmers on the Agricultural Stabilization and Conservation Service list. Farmers were asked to return a postcard indicating interest in being considered for the GT test. Positive responses were received from 287 farmers in Todd County and 170 in Shelby County. Of this number, 36 farmers in Todd County and 24 in Shelby were eliminated from consideration because they had party telephone lines. An additional 2 farmers in Todd and 3 in Shelby County were eliminated because they did not have local telephone service to the county seat (where the computer was to be located).

From this pool of interested farmers, county committees of farmers selected the 200 participants based upon criteria that would ensure adequate numbers of the different types and sizes of farms in the county. Therefore, the farmer selection process provided 200 Green Thumb users that represented the diversity of farms in the two counties.

Once selected, farmers were asked to sign an agreement to participate in the test (Appendix C). With respect to farm size, 16 percent of the farms were under 180 acres, 43 percent from 180 to 500 acres and 39 percent were of 500 acres or more. In addition, 30 or more farms raised each of the following commodities: corn, soybeans, wheat, tobacco, hay, dairy, beef, and swine.

G. Training

Training was conducted at two levels. Specialists and agents were taught how to enter information into GT by using the editor program of the state computer. An initial training session was conducted by Grumman personnel. Almost all of this effort was devoted to the procedures of accessing the computer, entering a message and making changes in an item. Little or no time was spent on deciding upon the appropriateness of information for GT or suggesting ways of displaying it. These decisions were left to the specialist or agent.

Training sessions were also conducted with farmers when they received the GT boxes. This session emphasized the steps in installing the box and instructions on use of weather and market information. After one month of operation another training session for farmers was held in each county for the purpose of determining what problems they were having and to provide assistance in the interpretation of weather and market information. Resource persons at each of these sessions included specialists in weather, market,

entomology, and rural sociology, as well as the county agents and area directors. It was observed that farmers had little or no difficulty with equipment installation and operation, but did have questions about the interpretation of information on the system. In addition, they made suggestions for additional information items.

IV

SYSTEM PERFORMANCE

This chapter examines the hardware and software components of the system.

A. Hardware

The hardware of GT included a state computer, two county processors, low-cost data terminals (referred to as Green Thumb Boxes), home telephones, and home color or black and white television receivers. The University of Kentucky College of Agriculture computer was used as the state computer. This unit received information from both extra-university and university sources. It then stored and transmitted this information to the two county processors. Each county processor was designed to respond to telephone requests from farmers. Farmers' home systems were composed of their own telephones and television sets and a Green Thumb Box (GTB). The connecting apparatus for these three pieces of equipment was a vf modulator, which joined the television to the GTB, and a modular extension plug, which linked the telephone to the GTB.

1. State Computer

The state computer, a Hewlett-Packard 3000, was in operation before the start of the project; therefore, the county processor had to be compatible with this unit. Specifications for the software for the state computer required that it automatically receive, sort, and format the weather wire and market data and to update the county processors every 15 minutes. The software included a program that permitted state Extension specialists and county agents to make remote entries of alpha numeric text from a conventional computer terminal. In addition, semigraphics and full graphics programs

were included in the software specifications for the state computer. Graphic displays were utilized primarily for presenting weather information.

2. County Processor

The second component of the system was the county processor. The two county processors used were Western Union GS-200 remote database microcomputers with 7 auto-answer 300 baud* modems for responding to Green Thumb Boxes and one 1200 baud asynchronous modem for communications with the state computer. In addition, a CRT terminal was located with the processor in order for the county Extension agent to be able to tie in to the state computer. The county processor acted as a store and forward computer system and also monitored and logged the traffic from each individual Green Thumb Box. The information recorded for each call by the monitoring function included (1) user ID, (2) time of day and date, (3) the number of the telephone line handling the call (of the 7 available), (4) duration of call, (5) information items requested and received, and (6) whether the call was successfully completed. This information was then retrieved by the state computer and used to determine how often each information item was requested and the performance of the system.

3. Green Thumb Box (GTB)

The key to bringing together the components for a home information system was the development of a reliable and low-cost electronic box to receive, store and display information on the TV screen. The general appearance of the Green Thumb Box and its connections to the TV and telephone are shown in Figure 1. The box is a low-cost data terminal for entering and receiving information from

*Baud rate stands for bits transmitted per second.

a computer over local dial-up telephone lines. It is a micro-processor controlled unit with internal software for storage of data, a 300 baud modem, a 16-item keypad for data entry and a radio frequency (vf) modulator to couple the video signal into Channel 3 or 4 of a color or black and white TV set. The Green Thumb Boxes were connected to the county processor by telephone through a modular plug telephone extension. All information requests by the farmer were entered into the Green Thumb Box before dialing the county processor and the telephone was automatically disconnected when the requested information was received and stored in Green Thumb memory (approximately 45 seconds to 3 minutes, depending upon how many items of information were requested).

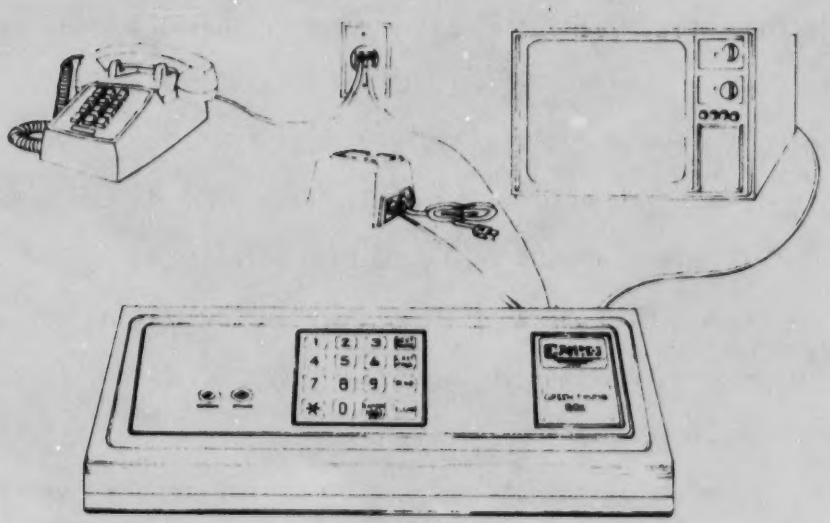

Figure 1. Green Thumb Box Interface

Only after the total transmission was received by the GTB were farmers able to view the frames on their television receiver. A farmer received up to a maximum of 16 items of information per phone call. A single information item was composed of a maximum of 4 TV screens of text and/or semi-graphics, or a single page of fine graphics. The GTBs had transmitting capabilities as well. Twenty farmers used this unit to send weather information to the Agriculture Weather Center via the county processors.

The user output was a visual display on a conventional color or black and white TV set. The display consisted of alpha-numerics in a format of 16 lines by 32 columns per screen, semi-graphics mixed with alpha-numerics, or a full graphics display. The alpha-numerics were displayed as a single color against another color background, whereas the semi-graphics offered a total of eight colors. Fine graphics lacked color capabilities and was too tedious and time consuming to be functional. As a result, it was hardly utilized during the project.

4. Telephone System

Communication between the GTB and the county processors was via dial-up telephone lines. A condition established by the telephone company was that users of Green Thumb had to be single-line customers. This was an important factor because there were many party lines in the two rural counties selected.

Based on past experiences of telephone traffic loads into data banks, it was estimated that seven lines into the county processors would handle most of the load from 100 users. Seven lines provided excess capacity. Telephone calls of Green Thumb users were local calls with no long distance charges involved.

B. Software

There were a number of computer-computer and human-computer interfaces in GT. At each point, software programs enabled this interchange. Since this system was new, computer software had imperfections that needed refinement. However, due to time constraints and inadequate personnel, software components were purchased from a vendor as a package as if they were hardware. Once acquired, the expectations were that they would function properly. Consequently, no computer technicians were added to the staff at the Agricultural Data Center. This placed the responsibility for the technical operations of GT onto the Senior Programmer at the Data Center. He had neither the time nor the expertise to make many of the necessary changes which would have improved the system's operation. In addition, after the decision was made to use existing staff, university administrators were reluctant to expend resources on major changes because of the limited time period of the test. These above factors severely limited the system's performance.

The most troublesome software problem was in the update program. Periodically, this program aborted, which caused the state unit to terminate its GT operation. The specific cause for this was never determined nor corrected. Rather, the most the Senior Programmer could do was examine symptoms of the problem. Because of the time overload on the Senior Programmer, ten months elapsed before the program was modified. Aside from not having much time, the Data Center also did not have the proper diagnostic equipment that could determine where or why problems occurred. Even after modifying the program, breakdowns in the update program continued to occur in one county. It became clear in this test that adequate programming staff dedicated to keeping a GT-type system operating are essential. And, if software is acquired from an outside vendor, a continuing contract for its maintenance and modification is a requirement.

C. Weather

The UK Agriculture Weather Center had unique hardware and software needs, and diversified departmental duties. The National Weather Service (NWS) transmitted weather indicators and maps to the Weather Center. The majority of these indicators, in the form of forecasts, advisories, and weather readings, were reformulated and entered manually into the state computer as text and semigraphic messages. Two full-time and five part-time staff members, working two shifts, performed these operations. The Cathode Ray Terminal (CRT) used for this function was not connected directly to the state computer until the 12th month of the test. Before this time, the staff had to compete with other computer users to get a line into the state unit. NWS maps were also entered manually through the use of a digitizer. This piece of equipment was tied directly into the state computer from the beginning of the project. Fine graphics was another capability that the Weather Center could utilize. However, there were problems in understanding this type display and it was too cumbersome and time consuming. Therefore, the Weather Director chose not to use this mode.

NWS could send approximately twelve severe weather bulletins like flooding, tornados, and snowstorms automatically into the state unit. Though important to the system, such warnings were used infrequently during the test.

In addition to preparing and presenting weather information, the Weather Center checked to see if their information reached the county processors. They were the only GT staff who performed this verification function with any regularity. The hours of the center were from 5:30 a.m. to 7:00 p.m. and, during those hours, they checked frame downloading every two hours. They performed this task because they had the necessary equipment (a GTB and a CRT located at the Weather Center), an adequate number of staff, and perishable information that required close monitoring. If the county units were not receiving their information, they reinitiated the update program. The need to

restart this program manually was a design feature of the software. Ideally, this should have had a provision for an automatic self-start when it failed.

By the end of 1980 the director of the Weather Center estimated that the system failed to update 50-70% of the time. Software modifications, changing the program to update Todd County first, were implemented in January. After the change, it continued to fail, but less frequently, (10-30% of the time). Originally, Shelby County was updated first and Todd County second. The program would hang up in Shelby County and never reach Todd County. These estimates indicate that after the sequence was reordered, the program performed better, but not perfectly. The point that needs reemphasizing is that as problems arose, personnel, equipment, and resources were not available to solve them. Minor adjustments were made to lessen the impacts of problems, but in many cases the important problems were never resolved because it would have required a major commitment of time and resources.

D. Market

Market information came from three different sources: state specialists, Agricultural Marketing Service, and the commodity futures markets. State specialists entered information manually through the state computer (see Chapter VI). Agricultural Market Service, a branch of United States Department of Agriculture, provided daily market prices to the GT database. However, due to inadequate interface between the two computers and an overloading of the Kentucky computer, transmissions were unreliable. According to AMS records, 18% of the items that were sent never reached the Kentucky computer and another 50% had errors that required editing. Since manual monitoring and editing were required, AMS limited transmissions to 8 items per day. Throughout the six month period, difficulties continued to exist. These problems resulted in the dropping of characters and missing lines. This occurred often enough to cause officials from AMS and UK to terminate the arrangement in April, 1981.

The major reason for discontinuing the service was concern with inaccuracy and unreliability.

Information from the commodity futures markets was provided by a private company--American Quotation Service (AQS). AQS sent data out every 15 minutes when the markets were open (9:30 a.m. to 1:30 p.m.); however, at times the state computer was unavailable to receive the information or unable to relay the information to the counties on a timely basis. Aside from GT duties, the state unit was serving the research, teaching, and Extension programs of the College of Agriculture. The important hours for market updates were also the times of peak computer usage for other functions. Consequently, the state computer was overloaded; all of its sessions were occupied. The result was the future prices were simply not consistently updated.

Other problems with futures prices occurred after AQS was purchased by Commodity News Service (CNS). The takeover occurred on January 1, 1981, but did not affect GT until CNS moved their operation on April 24, 1981. From this data until June 11, 1981, the futures market frames were not updated. Even after service was reinstalled, the wheat futures frame did not function properly for the next four months.

E. Performance of System Components

Aside from the specific problems in the update program and with weather and market information, a variety of other difficulties plagued the operation of the system. While at the same time, other aspects of GT functioned reliably. Each component is examined in the following section.

1. State Computer

   a. The Senior Programmer at the Agriculture Data Center estimated that the state computer failed to update the database an average of twenty-five hours per month, mostly due to routine maintenance. The HP's maintenance schedule consisted of one-half hour each morning and three hours on Friday afternoon. Unanticipated system breakdowns caused other update failures.

b. Heat problems during the summer months of 1980 caused the state computer to fail. This problem was solved when additional air conditioning capacity was added to the Data Center.

c. The demand on the state computer was near or beyond capacity. GT was not intended to be the primary function of the state computer, but was expected to handle several other functions for the College of Agriculture. When GT was initially implemented, it suddenly required from 1/3 to 1/2 of the state computer's resources during regular working hours. Halfway through the test, additional hardware was obtained which reduced this to 20-25% and eased some of the pressure.

2. County Microcomputers

a. Both computers had excess capacity for the task they performed.

b. County units sometimes failed because of surges and outages in the electrical supply, lightning, or extreme weather conditions. With no backup power source, there was a loss of memory in the computer that resulted in not only a loss of the database, but also the program indicating the location of the menu items. This then required running a program that reloaded the database and a "map" showing their location. To reload both county processors took an hour and a half.

c. Both county computers had problems with the monitoring and logging functions. These problems included:

(1) A nonexisting telephone port that recorded spurious calls.

(2) A series of calls were recorded repeatedly (up to three days at a time).

(3) Weather information transmitted to the county processors was erroneously sent back as farmers call.

(4) Problems in securing adequate equipment repair persisted throughout the test. Different personnel were often sent that were unfamiliar with the unit.

d. The Shelby County computer had unique equipment problems. These included:

(1) During April and May, 1980, the time clock recorded calls at nonexistant hours.

(2) A disc drive malfunctioned and was replaced early in the test.

(3) A faulty multiplexer caused problems from February, 1981, to May, 1981, with unsuccessful calls during this period rising to over 25% of the calls (compared to 13.9% over the length of the project).

(4) The county agent estimated that this computer failed on its own 35-40 times from April 1, 1980, to April 30, 1981. The Senior Programmer suggested that these failures may have been caused by environmental factors, in as much as this unit was located in an old building which was undergoing renovations. These changes included electrical rewiring. Resulting fluxuations in electrical power could have been enough to cause the unit to shut down. After failing, these units were not designed with any capacity to enable them to recover from an electrical problem. Another possible explanation was that high humidity caused the unit to fail. The Shelby County unit is located in the basement and has window air conditioning that does not run all the time.

e. The two county computers were located in Todd and Shelby Counties, which are both some distance away from Lexington where the majority of project staff was located. Therefore, in order to verify that information entered on GT was avilable to famers, it was necessary

to make a long distance call to access the information from one of the county processors. Budgetary constraints prevented securing a third processor for use as a verification and monitoring unit at the state level.

3. Green Thumb Box

   a. This unit was the most reliable piece of hardware equipment in the test. Out of 250 boxes, only 9 did not operate when initially tested. In the first 3 months of operation, 24 boxes failed and were returned for repair by the manufacturers. Since then very few boxes malfunctioned. Those that did were replaced quickly.

   b. Lightning storms were responsible for knocking out some of the boxes. Future units should be designed to protect the unit from electrical surges.

   c. The success rate for calls into both county processors was 89% (see Table 1). Although this percentage is high, it overstates the reliability for two reasons:

      (1) It calculated successful calls only when the county processor and GT box were both operating, and

      (2) It does not reflect unconnected calls into the county processor, e.g., a busy signal.

TABLE 1: PERCENT OF SUCCESSFULLY TRANSMITTED CALLS

	Shelby	Todd	Total
Successful	5,608	10,247	15,855
	84.4%	92.4%	89.4%
Unsuccessful	1,039	840	1,879
	15.6%	7.6%	10.6%

4. Telephone Lines

   a. At the transmission speed of 300 baud, the transactions between the county processor and the farmer's GT box were sent accurately. This

was in spite of the fact that some farmers in the test lived in remote rural areas often with telephone lines and equipment that are some years old.

b. The 1200 baud transmissions over leased lines between the state and county computers performed without problems.

c. Computer units were connected to one another through both leased and dial-up telephone lines. Leased lines have a direct connection between units, while computers sending data over dial-up lines run the risk of encountering a busy signal. The Agricultural Weather Center was linked with other units through both types of telephone lines. In some cases, they tied into NWS through leased lines and interfaced with the state unit over both leased and dial-up lines. American Quotation Service (later CNS) sent their market data over a leased wire to the state computer. Early in the test, the computer at Agricultural Market Service sent market items automatically over a dedicated (leased) line that eventually had to be changed to a manual interface with dial-up lines because of software problems. Leased lines were also used to join the county micro processors to the state computer.

The cost of leased telephone lines is on the basis of the distance of transmission, while dial-up lines are charged on the basis of connect time. In addition to cost, it is necessary to consider the time used in dialing and the probability of the line being busy. With GT, because of a promise of fifteen minute updates and the fact that the state computer performed other functions unrelated to GT, administrators used leased lines between as many units as possible. For future systems, telephone costs, update schedules, and the degree of dedication computer

units have to a GT-type system all need to be considered by planners before selecting telephone connections.

5. Telephone Ports

The seven telephone ports at the county processors provided excess capacity for the volume of incoming requests. These ports were reduced from seven to four in January, 1981, but still provided more than adequate service. Even though this has not been a problem, this component deserves some attention because of its importance for designing future GT-type systems.

Because of the unusual problems with the Shelby County processor, the following examines data from only the Todd County processor. For a thirteen-month period, the first two ports handled just under 98% of the requests, the third port processed about 2%, and the remaining ports handled infrequent overflows (see Table 2). This distribution stayed about the same from month to month. During the highest volume months, April - May, 1980, the first three lines handled 99.5% of the calls. Examining these months during the busiest time of the day (noon to one p.m.) showed that, even at this time, the first three ports handled all requests. Therefore, with one hundred farmers each averaging approximately twenty-one calls per month, two ports handled 96% of the calls and three ports managed over 99%.

F. Other Computer Functions

Aside from using computer networks for the purpose of downloading information, other possibilities need to be considered. Three other potential users are (1) personal transactions, (2) farm record keeping, and (3) problem solving through data analysis. The category of personal transactions represents an interactive, on-line, tree search system that enables the user to seek information on topics like entertainment, travel, restaurant, and real estate; to conduct banking transactions; and to shop through the computer for items as

TABLE 2: LINE LOADING OF TELEPHONE CALLS

Telephone Line	Shelby	Todd	Total
1	54.2%	79.4%	70.1%
2	38.8%	18.4%	26.0%
3	2.6%	2.0%	2.2%
4	1.8%	.1%	.8%
5-7	2.2%	0%	1.0%

varied as theater tickets and groceries. This system involves large main frame computers, many telephone ports, expensive start-up costs, and long-distance telephone charges. Because it is an on-line system and users tie up a telephone line for an extended period of time, unforseen problems with telephone traffic could result. Though the industry seems to be moving in this direction, many of these problems would have to be solved for such a system to be realistic for use with specialized audiences.

With farmers acquiring their own microcomputers, computer programs related to such farm functions as recordkeeping and problem solving through data analysis are appropriate to discuss in terms of their possible inclusion into an inexpensive GT-type delivery system. Both types of programs are being demanded by farmers, however, there are many technical problems in trying to combine information delivery and analysis programs into a single system. Analysis programs are relatively long thus requiring longer transmission times to send. This would contradict the idea of GT as a dump-and-disconnect system that can service many users. A second problem involves differences between the number of characters per line. GT had a maximum of 32 characters per line while most programs have 80 characters. If 80 character programs were reduced to 32, this would add to the problem of long transmission times. The fact

that some programs are written in different languages presents still another problem. If these technical problems can be worked out, then it would be worthwhile to pursue this type of multi-functional system. However, the present state of the technology seems to dictate that the different functions be carried out on separate systems. As mentioned in Chapter VI. these latter analysis functions could be handled through a library of available programs accessible at the county agent's office.

G. Generalizations

1. The Green Thumb Project had as its purpose to develop and test a computer-based information delivery system for farmers. The project accomplished that end.
2. Though malfunctions occurred with both hardware and software components of the system, there is nothing inherently wrong in the design of the system. The test domonstrated that such a configuration of hardware and software will work.
3. The state computer was a preexisting multi-use unit that became overloaded with the addition of Green Thumb.
4. The county processors contained more than sufficient capacity for the assigned tasks, but, in the case of one unit, there were numerous malfunctions.
5. Some GT Boxes suffered damage from lightening, but as a whole functioned adequately.
6. Telephone lines were a problem-free communication medium over the course of the test. This includes connections between information providers and the state unit, the state and county computers, and county and home terminals.

7. Even during peak usage in the early part of the test, three dial-up lines per 100 users proved to be adequate. Three lines handled 99% of the calls and two lines 96%.
8. Communications between computers caused problems throughout the test. These problems included failures of the update programs, incompatible equipment between AMS and the UK state computer, and malfunctions in the program that transferred call record statistics from the county processor to the state computer.
9. Environmental problems influenced the operation of the state computer and one county processor. Existing facilities are often inadequate for proper functioning of computer hardware.
10. Technical staff at the UK Agricultural Data Center did not have the time, equipment, or expertise to manage the GT system properly.
11. Due to software design, farmers had to wait until all of the requested information was loaded into the memory of their GT Box before they could begin viewing the information. This resulted in a waiting time of from 45 seconds to 3 minutes depending upon the magnitude of the request.
12. In addition to information delivery, farmers are requesting other computer services to handle such functions as farm record keeping and problem solving through data analysis.

H. Recommendations

From the experiences of the Green Thumb test, the following are recommendations concerning hardware and software components of the system:

1. If possible, a single vendor should provide all hardware and software components in the system. This would avoid a multitude of problems which affected the GT system (especially software links between units).

2. That a multi-use state computer not be used for a GT-type information delivery system. Rather, a unit dedicated solely to this purpose is desirable to insure timely and dependable information flow.
3. Reliable county-level equipment is essential inasmuch as technical personnel are not located in county Extension offices.
4. Equipment design should include a feature that handles the fluctuations in power levels found in rural areas.
5. In county offices that are not staffed 24 hours per day, the county processors need provisions for recovering from brief power outages.
   a. In case a failure does occur, "maps" for menu items should be stored on a disk not the ROM memory of the unit.
6. In order to attain acceptable levels of reliability, it may be necessary to develop a backup system that takes over when components of the primary system are malfunctioning.
7. When considering whether to link computer units to one another through leased or dial-up telephone lines, planners of future GT-type systems should consider telephone charges, update schedules, and the degree of dedication the computer units would have in their system. These factors all play a part in the costs and the length of time it takes for linkages to occur.
8. Software acquisition should not be treated as a finished product, but rather one that will require continuous adaptations and improvements. Adequate qualified programming staff will be necessary in order to handle these needs.
9. Precise graphic capabilities should be a high priority in this type of video system.
10. Farmers should be able to view their frame requests as they are loaded in the memory of the GT Box, thus avoiding unnecessary waiting time.

11. A county processor needs to be accessible to data entry personnel for purposes of verifying messages entered.
12. Software programs should have self-starting features in case a program terminates.
13. Staffing recommendations include the following personnel:
    a. Technician

       This person would need to have an electronic engineering background, programming skills, along with expertise in communications. He/she would be fully responsible for the operation of the system.

    b. Programmer(s)

       This person would need technical and programming language skills that coincide with the languages of the unit(s) making up the system.

    c. Staffing and resource needs have to be considered on an ongoing basis so that either indigenious staff can manage hardware or software problems, or the resources are available to handle them on a contract basis.
14. Equipment should be purchased that can perform diagnostic tasks to monitor system problems or breakdowns.
15. Special consideration should be given to environmental factors (humidity, faulty electrical wires) when locating hardware, since these factors might cause problems in the unit's operation.
16. Given the present state of technological development, attempting to combine the functions of information delivery and data analysis is ill advised.

V

USAGE INFORMATION

The information on system usage comes from an analysis of the computer records over the life of the test. This section is divided into the following parts: aggregate usage, types of requested information, time factors, use by background characteristics, and information requests by farm type and size.

A. Aggregate Usage

The thirteen-month test period of GT operation registered 29,371 calls into the system (see Table 1). In the first month there were over 5,000 calls for information, with use declining gradually to a low of just under 1,000 in the last month of the test period. This same trend held for both counties, however, the decline in Todd County was more gradual than in Shelby. The two counties in which GT has been operating have had different usage patterns. Todd County farmers have consistantly used GT more frequently. Though both counties had almost 100 users, sixty percent of the calls came from Todd County. On an average day, 42 calls were received in Todd County and 26 in Shelby. And in the last five months, usage in Todd County was approximately double that of Shelby County. Reasons for this disparity appear to be related to differences in farm and farm operator characteristics, as well as differences in reliability between the two county computers. These factors are discussed in later sections of this report.

Table 1 represents projected totals based on the extrapolation from computer records. All days are not represented because of problems in software and hardware components of the system. This does not mean necessarily that the system was shut down completely during these time periods. Software difficulties sometimes prevented retrieval of GT records from counties but did not interrupt information flow to farmers. The computer records are reported in Table 2.

TABLE 1: TOTAL GREEN THUMB USAGE FOR 13-MONTH TEST PERIOD*

Month	Shelby County	Todd County	Total
April	2310	2865	5175
May	1478	2445	3923
June	903	1944	2847
July	1261	2092	3353
August	1078	1819	2897
September	831	1266	2097
October	641	1103	1744
November	498	873	1371
December	424	973	1397
January	421	988	1409
February	305	840	1145
March	325	716	1041
April	261	711	972
Total	10,736	18,635	29,371

*Usage information represent extrapolated totals from valid days as reflected in Table 2.

At the individual level there was an average usage of 2.4 calls per user per week, or .34 calls per day. Again, it was higher for Todd County farmers than for Shelby County (.42 calls per day versus .25). Table 3 presents this information in a dichotimized breakdown by county.

These figures indicate that 35% of the users from both counties accessed GT information at least twice per week, while 65% were considered "low" users (less than twice/week). Inspecting usage by county, however, shows a distinct

difference with 44% of the farmers in Todd County being classified as "high" users while Shelby County had only 25% in this category.

However, average usage figures over the entire period of the test do not reflect the total picture. In order to better understand individual usage it is necessary to examine the monthly distribution in Table 4. However, this too can be misleading inasmuch as usage can vary within the month. This table delineates individual monthly usage though stated in weekly figures and, in addition, shows county monthly usage changes in these categories. For April and May, 1980, many farmers used GT two or more times per week in both counties. As the novelty wore off, usage dropped substantially. In Shelby County usage dropped off to the extent that by the third month half of the participants were not using the system. This figure remained fairly constant over the remainder of the test. In Todd County there were fewer nonusers and more moderate to heavy users. In both counties about 20% were infrequent users, but did not completely stop using the system. There was attrition in the more frequent user categories over the life of the project. Even so, figures for April, 1981 show that 62 farmers were still using the system after thirteen months of operation. This indicates that in spite of hardware problems in Shelby County (1/3 of the calls during April were unsuccessful) and problems in futures market updating, a third of the farmers in the test continued to use GT.

TABLE 2: USAGE BY COUNTY BY MONTH

Shelby County (N = 93)

Month	Number of Calls	Days	Average Per Day
April	2,157	28	77.0
May	811	17	47.7
June	211	7	30.1
July	244	6	40.7
August	139	4	34.8
September	400	15	27.7
October	622	30	20.7
November	397	24	16.6
December	302	22	13.7
January	314	23	13.6
February	260	24	10.9
March	231	22	10.5
April	208	24	8.7
13 Month Total	6,296	246	25.6

Todd County (N = 98)

Month	Number of Calls	Days	Average Per Day
April	1,815	19	95.5
May	1,737	22	78.9
June	583	9	64.8
July	135	2	67.5
August	704	12	58.7
September	928	22	42.2
October	1,033	29	35.6
November	612	21	29.1
December	816	26	31.4
January	893	28	31.9
February	660	22	30.0
March	532	23	23.1
April	639	27	23.7
13 Month Total	11,087	262	42.3

TABLE 3: HIGH-LOW GT USAGE FROM APRIL 1, 1980 TO APRIL 31, 1981[1]

	(N)[2]	High	Low
Shelby	(91)	25%	75%
Todd	(93)	44%	54%
Both Counties	(184)	35%	65%

Chi Square = 7.175 Significance = .007

[1]High use equals an average of two times or more per week. Low use equals an average of less than two times per week. These definitions will be used throughout the rest of the chapter.

[2]N = number of users.

TABLE 4. AVERAGE WEEKLY USE FROM APRIL, 1980 TO APRIL, 1981

Shelby County (N = 93)

Month	No Use (zero)	Infrequent (1 time/wk or less)	Moderate (2-3 times/wk)	Frequent (4-6 times/wk)	Heavy (7 or more times/wk)
Apr. (1980)	3	10	33	23	24
May	16	20	30	12	15
June	58	10	6	9	10
July	57	5	11	8	12
Aug.	x	x	x	x	x
Sept.	55	14	11	7	6
Oct.	45	21	19	5	3
Nov.	53	23	10	4	3
Dec.	58	16	14	2	3
Jan.	58	15	16	3	1
Feb.	62	18	7	4	2
Mar.	61	19	8	3	2
Apr. (1981)	73	8	7	4	1

Todd County (N = 98)

Month	No Use (zero)	Infrequent (1 time/wk or less)	Moderate (2-3 times/wk)	Frequent (4-6 times/wk)	Heavy (7 or more times/wk)
Apr. (1980)	11	12	20	24	31
May	12	14	17	25	31
June	30	10	17	18	23
July	x	x	x	x	x
Aug.	38	11	9	19	21
Sept.	40	22	9	16	11
Oct.	36	23	16	15	8
Nov.	51	12	19	6	10
Dec.	42	17	20	9	10
Jan.	43	19	14	13	9
Feb.	53	13	12	10	10
Mar.	56	15	11	10	6
Apr. (1981)	56	14	10	11	7

B. Information Requested

1. Amount of Information Requested

On the average, users requested 4.2 information items per call. The distribution can be seen in Table 5. Over two-thirds of the calls were for 3 to 6 items; though it should be recognized that a substantial number of persons wanted only a single item while others wanted as many as ten.

TABLE 5: NUMBER OF FRAMES REQUESTED PER CALL

Number of Frames	Shelby	Todd	Total
1	10%	6%	9%
2	10%	8%	9%
3	14%	24%	19%
4	16%	14%	15%
5	13%	12%	12%
6	11%	12%	12%
7	7%	6%	6%
8	7%	7%	7%
9	4%	4%	4%
10	8%	7%	7%

2. General Types of Information

There were sixteen categories of information available to GT users. For descriptive purposes, they are listed here under eight general headings: market, weather, agricultural production, county information, home economics, community information, youth information and the menu listing. Table 6 reports the selection of each for the 13-month period.

By far, the most heavily accessed topics were market and weather information. These categories represented 55.5% and 30.6% of the total requests, respectively. County Information was the next highest category making up 4.0% of total requests, followed by Agricultural production advisories and Home Economics.

TABLE 6: MOST REQUESTED CATEGORIES OF INFORMATION

	Shelby	Todd	Total
Market			
1. Commodity futures prices	20.5%	50.8%	40.1%
2. Market interpretation	6.4%	8.4%	7.5%
3. Regional livestock and grain prices	5.9%	3.4%	4.3%
4. Specialists information	2.8%	1.6%	2.1%
5. Agricultural Marketing Service*	2.8%	.8%	1.5%
	38.4%	65.0%	55.5%
Weather			
1. Forecasts	24.3%	16.7%	18.9%
2. Maps (radar and surface)	11.8%	7.2%	9.0%
3. Agricultural weather advisories	3.3%	1.3%	2.2%
4. Severe weather forecasts	.7%	.3%	.5%
	40.1%	25.5%	30.6%
Agricultural Production			
1. Plant Diseases	2.1%	.5%	1.0%
2. Horticulture	1.3%	.4%	.7%
3. Entomology	1.1%	.4%	.6%
4. Agronomy	1.0%	.4%	.6%
5. Agricultural Engineering	.5%	.3%	.4%
6. Animal Science	.6%	.2%	.4%
7. Forestry	.0%	.0%	.0%
	6.6%	2.2%	3.7%
County Information			
1. County News	7.0%	2.4%	4.0%
Home Economics			
1. Home Economics	2.7%	1.7%	2.1%
Community Information			
1. Resource Development	.4%	.3%	.3%
2. Rural Sociology	1.1%	.4%	.6%
	1.5%	.7%	.9%
Youth Information			
1. 4-H	.4%	.5%	.5%
2. World of Work	.4%	.3%	.4%
	.8%	.8%	.9%
Other			
1. Menu Listing	3.0%	1.6%	2.0%

*Only operated for six months.

Under the marketing category, commodity futures prices were the most requested frames in both counties. The next most popular were the frames on market interpretation. American Quotation Service (later Commodity News Service) supplied these items. Regional prices comprised the third most popular category, while specialists information, followed by Agricultural Marketing Service (AMS), were accessed fourth and fifth, respectively.

Although AMS information was the least accessed information, its importance to future GT-type systems is considerable. This pilot study was not a fair test of AMS information for the following reasons: 1) As a trial, AMS downloaded only eight information items out of a possible eight hundred (1% of those available). Software incompatibility was a major technical problem (see "System Performance" for greater detail). 2) AMS supplies private firms like AQS with a major portion of their information. The private firms then add interpretational analysis to this information and send it to their subscribers. In the case of GT, AQS provided these items to the state computer's. Officials from AMS have stated that they would be willing to supply any of their information that fits a state's agricultural needs. This would include commodity futures prices on a limited update schedule (e.g. three times per day). Extension specialists within the state could then add interpretive information like was being supplied by AQS. 3) The percentage of use for AMS frames was low during the test because AMS only sent information to Kentucky from late October, 1980 to March 1981. This was compared to a full thirteen months in the other categories.

The four categories of weather information, according to frequency of request, were forecasts, maps, agricultural advisories, and severe weather forecasts. NWS supplied the forecasts, maps, and severe weather alerts. Forecasts were by far the most frequently requested items of weather (19%), followed by radar and surface maps (9%). Somewhat surprisingly, the agricultural weather advisories were not heavily used. The least requested items, as one would expect, were severe weather warnings.

Since market and weather constituted the bulk of the requests, they were graphed separately by month in each county (see Figures 1 and 2). In Shelby County the request pattern changed over the course of the test. These changes, when examined in terms of seasons of the year, indicated that Shelby County farmers were more interested in weather information from late winter to the early fall and marketing information during the height of the fall and winter seasons. Considering this usage cycle in relation to the type of farms (mostly livestock and mixed farms), seasons of the year, and agricultural cycles leads to the conclusion that farmers consult weather frames for planting, cultivating, and harvesting their crops, and to a lesser extent to tend their livestock. Marketing frames became more important during the fall and winter months. No doubt, this information assists farmers in deciding when to buy, store, or sell farm products/inputs.

In comparison, the Todd County request pattern remained unchanged. These farmers are mostly crop farmers and, as such, were more interested in market information year round. Consequently, as Figure 2 clearly shows, they accessed marketing frames consistently more each month than weather frames. For the entire period, percentages were 61.3% for market and 25.8% for weather.

3. Specific Items Requested

Based on county differences in farm characteristics, specific frame requests reflected different farming needs (see Table 7). In Shelby County, six of the top ten frames were weather frames; while, by contrast, six marketing frames were among the top ten in Todd County. The most requested frame for both counties was soybean futures prices, but the percentage difference favored Todd County by 8.1 percentage points. Throughout the test, Todd County farmers accessed corn futures

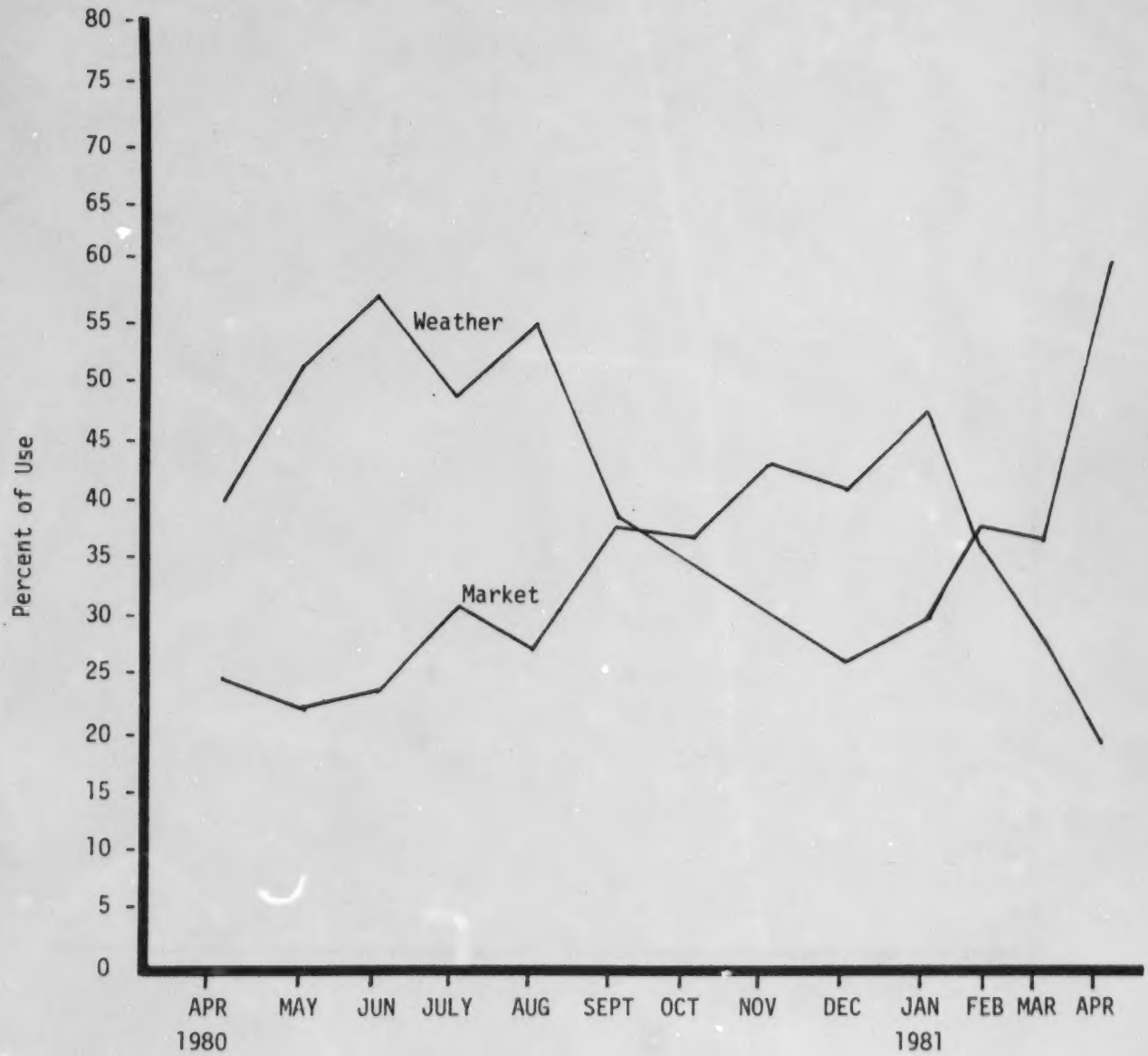

Figure 1. Use of Weather and Market Information in Shelby County

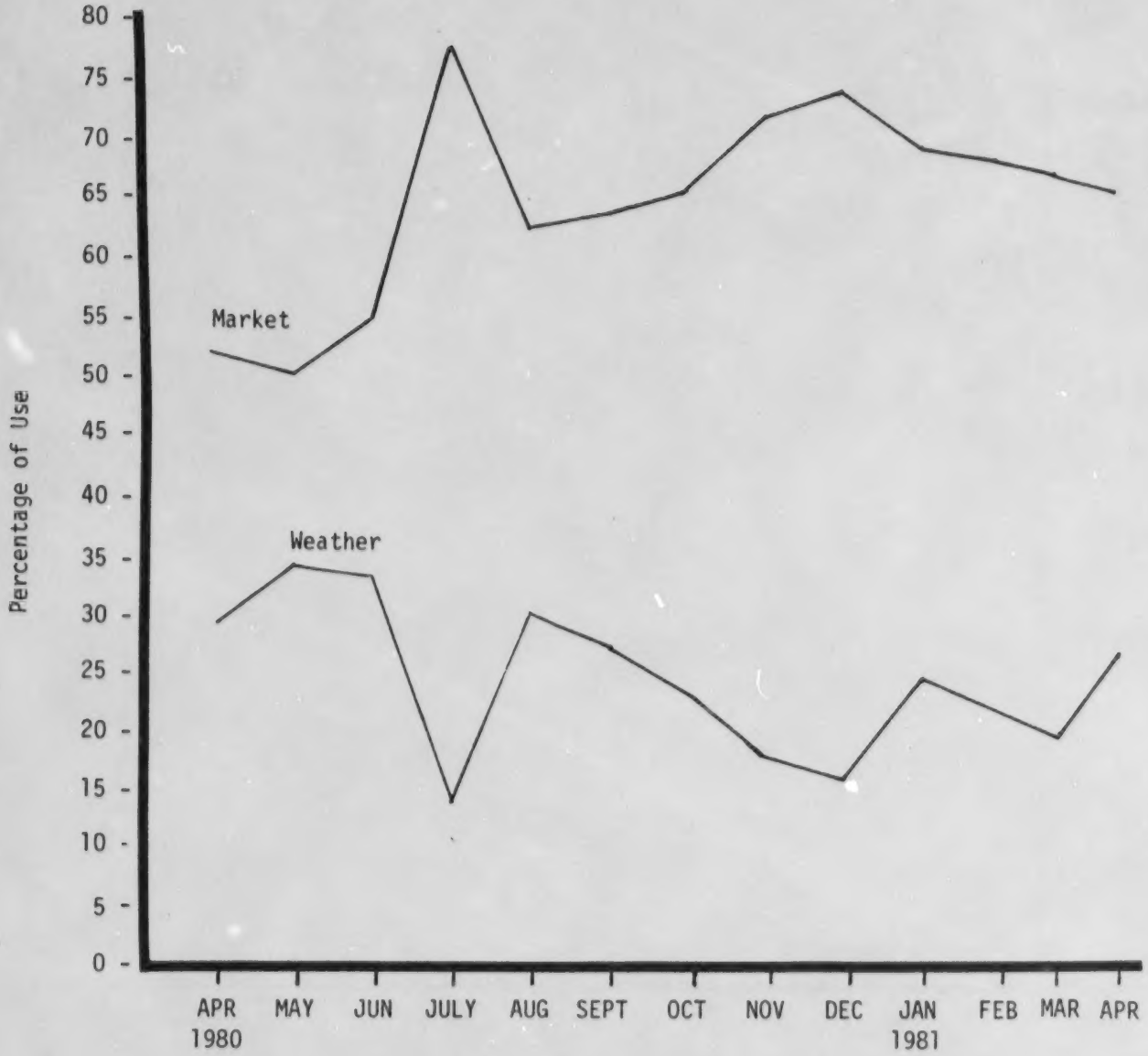

Figure 2. Use of Weather and Market Information in Todd County

Table 7. Ten Most Requested Frames

Shelby County		Todd County	
Frame	%	Frame	%
1. Soybean futures prices	7.3%	1. Soybean futures prices	15.4%
2. County weather forecast	6.5%	2. Corn futures prices	13.6%
3. 3-5 day weather forecast	6.0%	3. Wheat futures prices	12.0%
4. Corn futures prices	5.8%	4. County weather forecast	6.5%
5. State weather radar map	4.1%	5. Live hog futures prices	4.2%
6. Wheat futures prices	4.1%	6. 3-5 day weather outlook	4.1%
7. State weather forecast	3.8%	7. Live cattle futures prices	3.5%
8. National weather radar map	3.7%	8. Market commentary	3.0%
9. 6-10 day extended weather outlook	2.0%	9. State weather radar map	2.3%
10. Regional corn prices	1.9%	10. National weather radar map	2.0%

second most frequently and wheat futures third. Notably, the cumulative percentage for these three frames in Todd County was 41%.

In Shelby County, soybean futures was the most frequently accessed during each month, while corn and wheat futures markets were only seasonably popular. During the fall and winter, these latter two were accessed more frequently than in the spring and summer seasons. In fact, in the high access periods, the three grain futures markets were requested in the same one, two, three order as the Todd County selection. Other marketing information, such as regional corn prices, regional bean prices, market commentary, and the Kentucky grain market summary were also in the ten most requested items at this time. In the spring, summer, and early fall, weather information, in general, and the county forecast and the 3-5 day forecast in particular, were more frequently accessed. Of additional interest, local weather items were chosen more than national and state weather information.

C. Time Factors

Time is an integral feature of GT from the perspective of both the farmers and the information providers. From the farmers' viewpoint, important GT attributes include its timeliness, availability upon demand, and capsulization of information. These features may facilitate decision-making processes by providing current information that can supplement traditional methods. From the perspective of information providers, it has the potential for speeding the flow of information.

With this in mind, there are three factors covered in this section. The first two are from the farmers' perspective and examine when, during the day, requests are made and the amount of transmission time required. The third is the frequency of frame updates from the point of view of both farmers and information providers.

1. Time of Request

Figure 3 presents a breakdown by time of request in each county. For both counties, peak use was bimodal. The highest use period was from 11:00 a.m. to 2:00 p.m. No doubt, this was influenced by the opening and closing of the commodity markets. The second peak period was from 5:00 p.m. to 8:00 p.m. or before or after the family dinner. The morning (7:00 a.m. to 11:00 a.m.), late afternoon (2:00 p.m. to 5:00 p.m.), and late evening (8:00 p.m. to 1:00 a.m.) were moderate use periods. Finally, GT was used least in the early morning period (1:00 a.m. to 7:00 a.m.). This daily request pattern varied little during the test period and can probably be generalized to a future GT system or similar agricultural informational systems.

2. Transmission Time

The GT system downloaded requested information into the memory of the GT box and was designed such that the user could view only the "greeting" page during the period of transmission. The total period of transmission varied depending upon the number of information items requested and the number of screens (pages) in each item.

The transmission time of the average call was 1 minute and 48 seconds, and ranged from 46 seconds when requesting a single information item up to almost 3 minutes for 10 items. A frequent comment of users was that they had to wait too long to receive the information. A minute and a half is either very brief or a long time depending upon your perspective. It should be pointed out that the perception of time spent waiting was possibly exaggerated because users could not view the information (except the greeting page) as it was being loaded. A change in this design feature would be recommended for future systems.

Figure 3. Calls by Hour of the Day

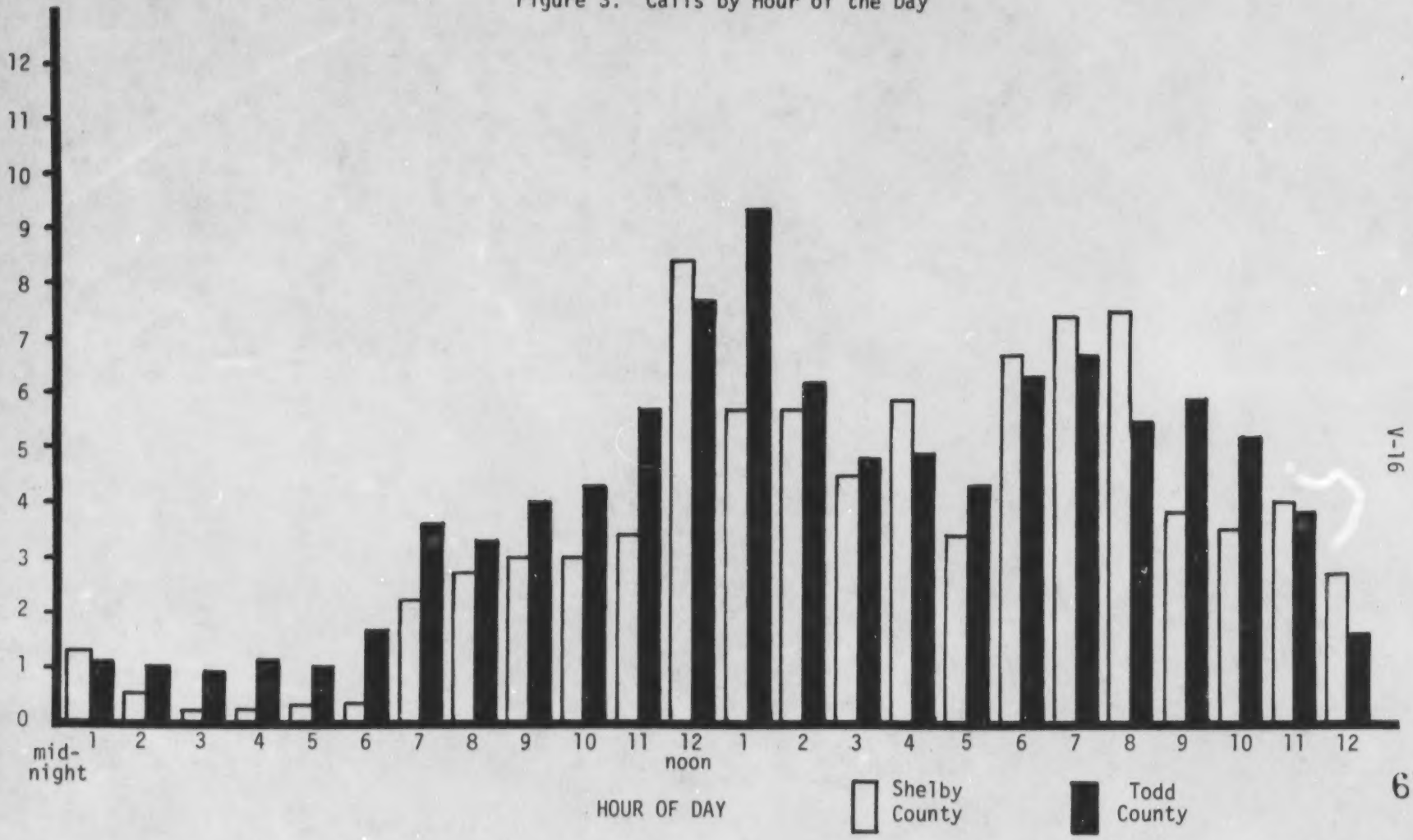

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Table 8 shows the average transmission time for the different numbers of frames requested. It is evident that the time per frame declines as more are requested. The transmission time for a user requesting four frames was about 25 seconds per frame.

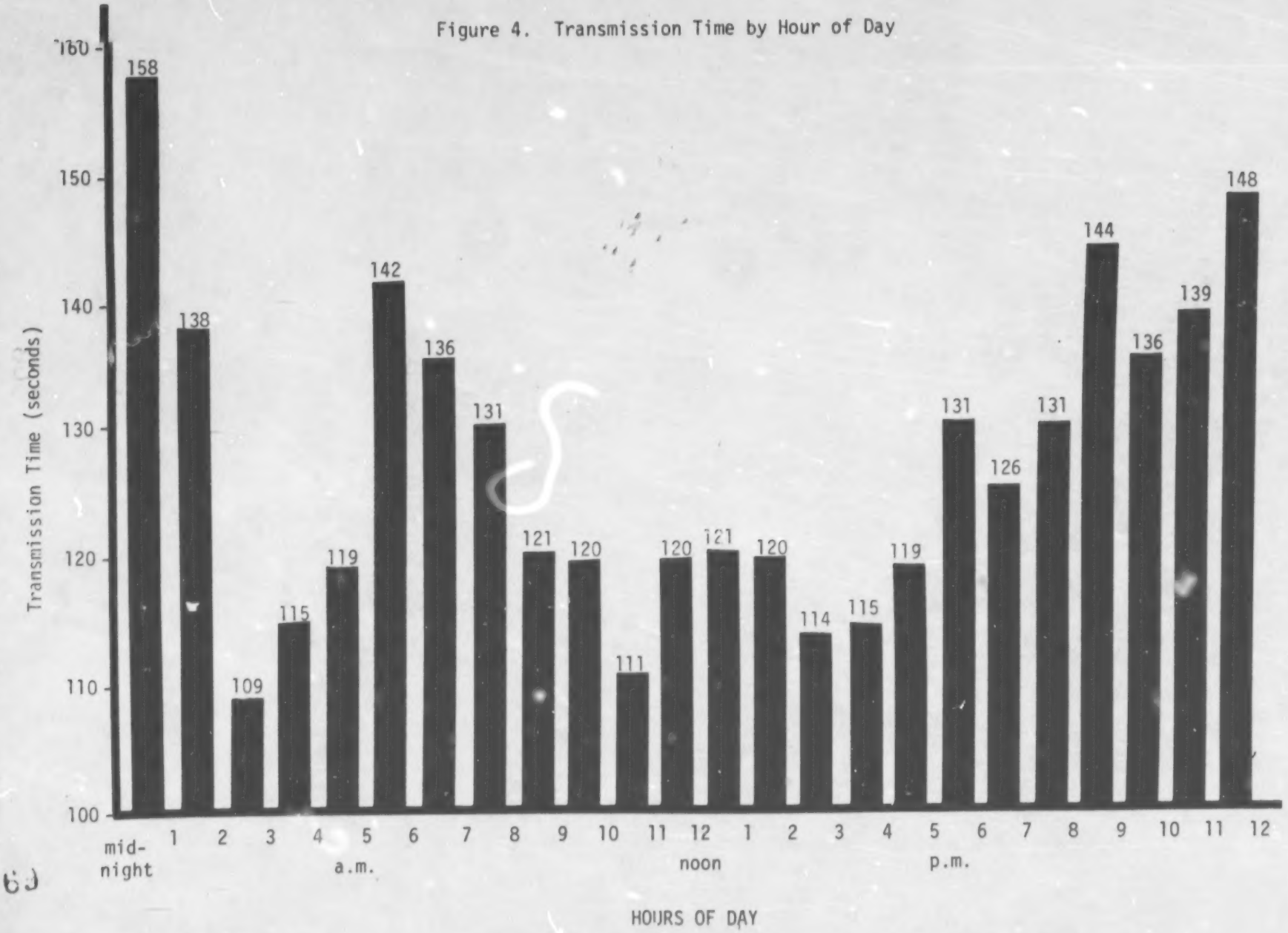
TABLE 8: TRANSMISSION TIME BY NUMBER OF FRAMES REQUESTED

Number of Frames	Shelby (seconds)	Todd (seconds)	Overall Average (seconds)
1	48	44	46
2	68	62	64
3	87	78	80
4	107	98	102
5	133	115	121
6	149	128	135
7	162	144	151
8	154	147	149
9	175	169	171
10	171	149	157

It took slightly longer to transmit the same number of frames in Shelby County than in Todd; however, differences in the transmission time between the two counties can be explained largely by differences in the type of information requested. Shelby County users requested weather information more frequently, and weather maps require more memory capacity and thus more transmission time.

Transmission time in the middle of the day when commodity markets are open is inversely related to the number of calls (see Figure 4). Farmers were calling for a few specific marketing frames and were requesting few other frames. It is also likely that farmers had less time to consider other information. On the other hand, during the evening and morning hours more frames were being requested in a single

Figure 4. Transmission Time by Hour of Day



call. Usage in the evenings and mornings reflects the fact that farmers had more time to study GT information during these hours.

3. Updates

The need for updating information varies with the timeliness of the information. For most marketing information the demand is for it to be very current. Some weather must be handled in a similar fashion, while others can be updated daily or weekly. Though some agricultural advisories need to be disseminated quickly, weekly update schedules seem suitable for most information that state and county Extension personnel disseminate. These schedules need to be superceded when emergency conditions in any speciality area require information to be delivered immediately. An "alert page"* was spawned out of this need.

Related to update schedules is the technical feasibility of maintaining a delivery schedule that is "reasonably" affordable. Technically, most schedules can be implemented if user/public/private sources are willing to pay the price. Cost factors related to frequency of update need to be examined in relationship to farmers' expectations and needs. Delivery costs fall under three broad areas: 1) hardware/software, 2) cost for information, and 3) communication system e.g., telephone costs. Update schedules directly translate into the dependibility, capacity, and timeliness of the delivery system.

In this regard, the present test has shown that market information is perhaps the most crucial in terms of update, as well as the greatest source of farmer dissatisfaction when they are not current. Before the project began, farmers were told to expect crop and livestock futures market updates every fifteen minutes. Because markets were not always sent by the information provider and the state computer was often too busy to receive and relay it to the county computers, updates

*The alert page is described in Chapter VI-B.

were not always on schedule. Therefore, user expectations were not always met and dissatisfaction resulted. In the case of GT, an ambitious update schedule was communicated to the user at the outset thus establishing these expectations.

Figure 5 illustrates market updates by comparing the county time and the date stamp on the soybean futures market. These data were gathered through spot checks on the Todd County soybean futures frames from December, 1980 to February, 1981. When the system was operating, the average update period was approximately 35 minutes for the 3 months. The descrepancy between expectations and actual performance undoubtedly reduced usage in this test.

In addition to inspecting future market updates, a spot check on the recency of updates on all GT frames was made on April 6, 1981. Admittedly, no conclusions can be drawn from one check, however, it does provide an indicator of update schedules. Table 9 presents the results from the spot check by showing the average number of days since the last update.

On this particular day, the Weather, Market, and Agricultural Economics frames were updated on April 6. 4-H, Plant Diseases, Home Economics, Resource Development, World of Work, and Horticultural were within or close to a weekly update schedule, while the rest of the departments far exceeded a weekly schedule. However, some frames do not require continuous updating. To use a rural sociology frame as an example, county population is a nonperishable piece of information that does not require regular changes.

Update differences between the counties varied substantially. In one county, frames averaged 30 days since the last update which may be marginally acceptable to users. In the other county, frames were

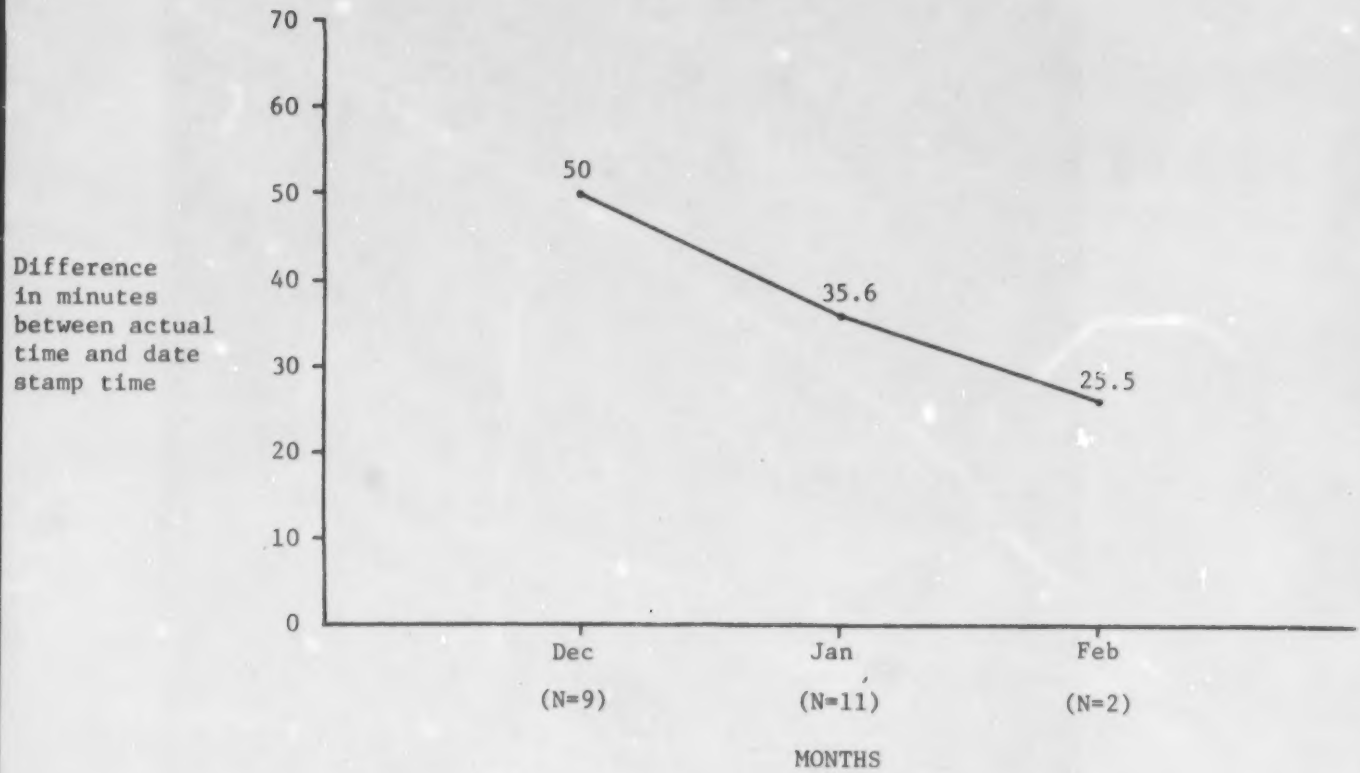


Figure 5. Frequency of Soybean Futures Market Update During December, January and February

Table 9 . Spot Check on Frame Updates - April 6, 1981*

Category	Number of Frames	Average Number of Days Since Last Update
Todd County News	19	30 days
Shelby County News	21	75 days
Weather Information	20	current
Market	27	current
Pest Management	4	80 days
4-H Information	10	7 days
Home Economics Information	27	7 days
Resource Development Information	10	5 days
Agricultural Economics Information	10	current
Agricultural Engineering Information	4	170 days
Agronomy Information +		
Tobacco Production	4	35 days
Other frames	14	280 days
Animal Science Information +	3	80 days
Entomology +	10	75 days
Horticultural	3	5 days
Plant Disease	9	10 days
Rural Sociology	6	180 days
World to Work Information	6	13 days
Forestry - Never put any information on their frames.		

* Weather, Market, Home Economics, Agricultural Economics, and Plant Disease had frames which were not averaged in because the information was not outdated even though the frame had not been changed recently (ie., 30 day outlook).

+ Agronomy (2), Animal Science (9), and Entomology (1) had frames with no information on them.

updated two and a half months prior to April 6, 1981. This would likely be less acceptable to farmers and reduce system usage. Hardware problems prior to this time need to be considered. For example, frame changes may have been made and not processed by the state computer, or since the county computer was periodically down, county personnel felt that maintaining an update schedule was futile.

For organizing a future system, it is noteworthy that some Extension specialists produce weekly newsletters. There is no reason why this information could not be capsulized and used on GT. This would serve two functions: first, it would save time for state specialists by making more extensive use of information currently being produced and second, it would maintain user interest by providing fresh weekly information.

D. Relationship of Background Variables to GT Use

This section is divided into two parts. The first examines the relationship of farm characteristics to farmers' GT use, while the second portion focuses upon socio-economic variables and use.

1. Farm Characteristics

Important criteria considered in the selection of Todd and Shelby counties to receive the GT program were the types of farms in these two parts of the state.

Todd County has a total farm income of approximately thirty-three million dollars, coming primarily from soybeans, corn, tobacco, and wheat. The county has 871 farms with an average size of 218 acres. Sixty-five percent of the county farm income comes from crops, while the remaining 35% is divided between hogs, cattle, dairy, and poultry. Because of the emphasis on cash-crop production, Todd County farms are fairly large by Kentucky standards. One-third of the farmers are categorized as part-time (1978 Census of Agriculture).

In contrast, Shelby County has 1,588 farms with an average size of 142 acres. The county's income from agriculture is about forty-one million dollars, with 43% coming from crops (three-fourths of which was tobacco) and 57% from livestock. Tobacco, dairy, beef, and grains are the most important commodities produced in the county. There are some large scale farms in the county, but the majority are under 180 acres. Nearly half (48%) of the county's farmers report employment other than farming as their principal occupation (1978 Census of Agriculture).

a. Farm Type

The following data relate farm characteristics to GT usage. Table 10 divides farms into three categories: crop, livestock, and mixed. The basis for coding farm types was contingent on whether the crop and/or livestock operation accounted for at least one-third of total farm sales.

The following conclusions can be drawn: 1) overall, crop farmers are the highest GT users, livestock farmers are the lowest users,* and mixed farmers fall in the middle of these two groups; 2) there is a considerable difference between the number of specialized crop farmers in Todd County (N=39) and the number in Shelby County (N=5); and 3) Todd County farmers are higher users of GT than Shelby County farmers in every category.

A fourth consideration, while not presented on Table 5, is worthy of mention: Shelby County mixed farms grow crops to support their livestock operations, whereas Todd County farmers tend to market their crop production. GT use by mixed farms is similar to crop farms where mixed farms market their crops. Those mixed farmers who grow crops to support livestock operations seem to be interested in information for purposes of crop production. Consequently, this latter group residing totally in Shelby County does not have the need to use GT as frequently.

TABLE 10. GT USE BY FARM TYPE

	Shelby			Todd			Total		
Farm Type	(N)	High	Low	(N)	High	Low	(N)	High	Low
Crop	(5)	20%	80%	(39)	44%	56%	(44)	41%	59%
Livestock	(18)	17%	83%	(2)	50%	50%	(20)	20%	80%
Mixed	(61)	28%	72%	(38)	50%	50%	(99)	36%	64%

Chi square for total = 2.68 Significance = .263

b. Crops

Crop and livestock farmers have different informational and operational demands that influence their use of GT information. Crop producers have the need for timely weather and market information in making production and marketing decisions, the two areas which were the focus of GT. In this regard, the specific crop type is not as

*Definition of high-low is found in Table 3 of this chapter.

important because most crop farmers have an interest in grain futures market prices. Additionally, grain farmers often double crop and interchange their crops making crop specificity less important to categorize and relate to GT usage. Because the majority of crop farmers are in Todd County, this helps partially explain why Todd County farmers use GT more than Shelby County farmers. A second factor is that specialized crop farmers are more dependent on farm income for their livelihood and thus more likely to take the time to use GT (80% of crop farmers earn a majority of their income from the farm compared with only 33% for livestock farmers).

c. Livestock

Livestock producers are not as dependent on market fluctuations and weather as crop farmers. Therefore, the timely nature of GT is not as crucial for running their operation. This factor, along with the fact that two-thirds of the livestock farmers earn more than fifty percent of their income from off-farm sources, point out two reasons for low GT use among this group. Table 11 shows GT usage by specific type of commodity produced.

Thirty-six percent of the GT farms are some type of beef farm, that is, they are wholly beef farms or beef farms combined with crop farming and/or other livestock operations. Most of these beef producers are low GT users. In fact, two-thirds of them fall into the "low" user category.

Dairy farms are the second most frequently represented livestock farm in the sample (either alone or in some combination). Not unexpectedly, they proved to be very similar to beef farmers in their use of GT. Two-thirds of the dairy farmers were "low" users (and one-third "high").

The third most frequent livestock farm type is hog farms. There are a total of 30 hog farmers of various combinations in the sample. Thirty percent of this total were "high" GT users.

Therefore, this breakdown by specific type of livestock raised reflects few differences in GT use. What is evident, however, is that usage is greater for farms that combine crop and livestock production. These farms have many of the same information needs as do specialized crop producers.

TABLE 11. USE BY COMMODITY

	(N)	High	Low
Cash Crop	(44)	41%	59%
Beef	(9)	11%	89%
Dairy	(6)	33%	67%
Hog	(2)	0%	100%
Horse	(1)	0%	100%
Hog and Beef	(2)	50%	50%
Beef/Crops	(43)	33%	67%
Dairy/Crops	(23)	35%	65%
Hogs/Crops	(12)	67%	33%
Beef and Dairy/Crops	(5)	20%	80%
Beef and Horse/Crops	(1)	0%	100%
Beef and Hogs/Crops	(12)	25%	75%
Hogs and Dairy/Crops	(1)	0%	100%
Hogs and Poultry/Crops	(1)	100%	0%

d. Farm Organization

The second farm characteristic considered is farm organization. This variable is divided into family farms, farm partnerships, and corporate farms (Table 12).

Overall, corporate farms are the most frequent users, followed by family farms and partnerships. However, there is a small number of corporate farms in the participant group and there is a wide disparity between counties. Furthermore, many of these farm firms are incorporated family farms. The relationship between use and family farm also varies by county, with 44% of those in Todd County and 23% in Shelby County being high users. Thirty-one percent of partnerships fall in this same category of using GT two or more times per week.

Though the type of farm organization shows some differences in use of GT information, it is anticipated that most differences can be explained by variations in such factors as farm size and type and the relative use of information in decision-making. For example, corporate farms are larger in size and crop farmers receive less off-farm income.

TABLE 12. GT USE BY FARM ORGANIZATION

Farm Organization	Shelby (N)	Shelby High	Shelby Low	Todd (N)	Todd High	Todd Low	Total (N)	Total High	Total Low
Family farm	(64)	23%	77%	(66)	44%	56%	(130)	34%	66%
Partnership	(18)	33%	67%	(14)	29%	71%	(32)	31%	69%
Corporation	(3)	33%	67%	(4)	100%	0%	(7)	71%	29%

Chi square for total = 4.36 Significance = .113

e. Farm Size

The association between the size of the farm (in acres) and GT usage is presented in Table 13. The total number of farms is divided fairly equally between five different categories of farm size.

Considering the counties together shows that, in general, as farm size increases the percentage of "high" users also increases. However, though this relationship is evident in Todd County it is

less clear in Shelby County. In Shelby County use by farms of smaller size is slightly higher than for medium size farms, except that for farms of 1,000 acres or more where usage jumps up to 60%. Therefore, only farmers on the largest farms in both counties are consistently high users of GT. With the difference between farm size in the two counties (6% of the Shelby County farms are 1,000 acres or over compared to 19% in Todd County), Todd County farmers show up as more frequent GT users. However, as Figure 6 shows, differences by farm size are minimal. The plot of the bivariate relationship produces a least squares line that rather than showing an upturn in usage above 1,000 acres, actually descends because of low usage by those farmers on farms just below 2,000 acres. Because the line is almost flat throughout, this graph presents a clear visual illustration that farm size had little effect on usage.

TABLE 13. GT USE BY FARM SIZE

Farm Size (Acres)	Shelby			Todd			Total		
	(N)	High	Low	(N)	High	Low	(N)	High	Low
180 or less	(25)	28%	72%	(8)	38%	62%	(33)	30%	70%
181-339	(21)	24%	76%	(12)	33%	67%	(33)	27%	73%
340-499	(14)	29%	71%	(21)	43%	57%	(35)	37%	63%
500-999	(17)	12%	88%	(27)	56%	44%	(44)	32%	68%
1000 or more	(5)	60%	40%	(18)	56%	44%	(23)	57%	43%

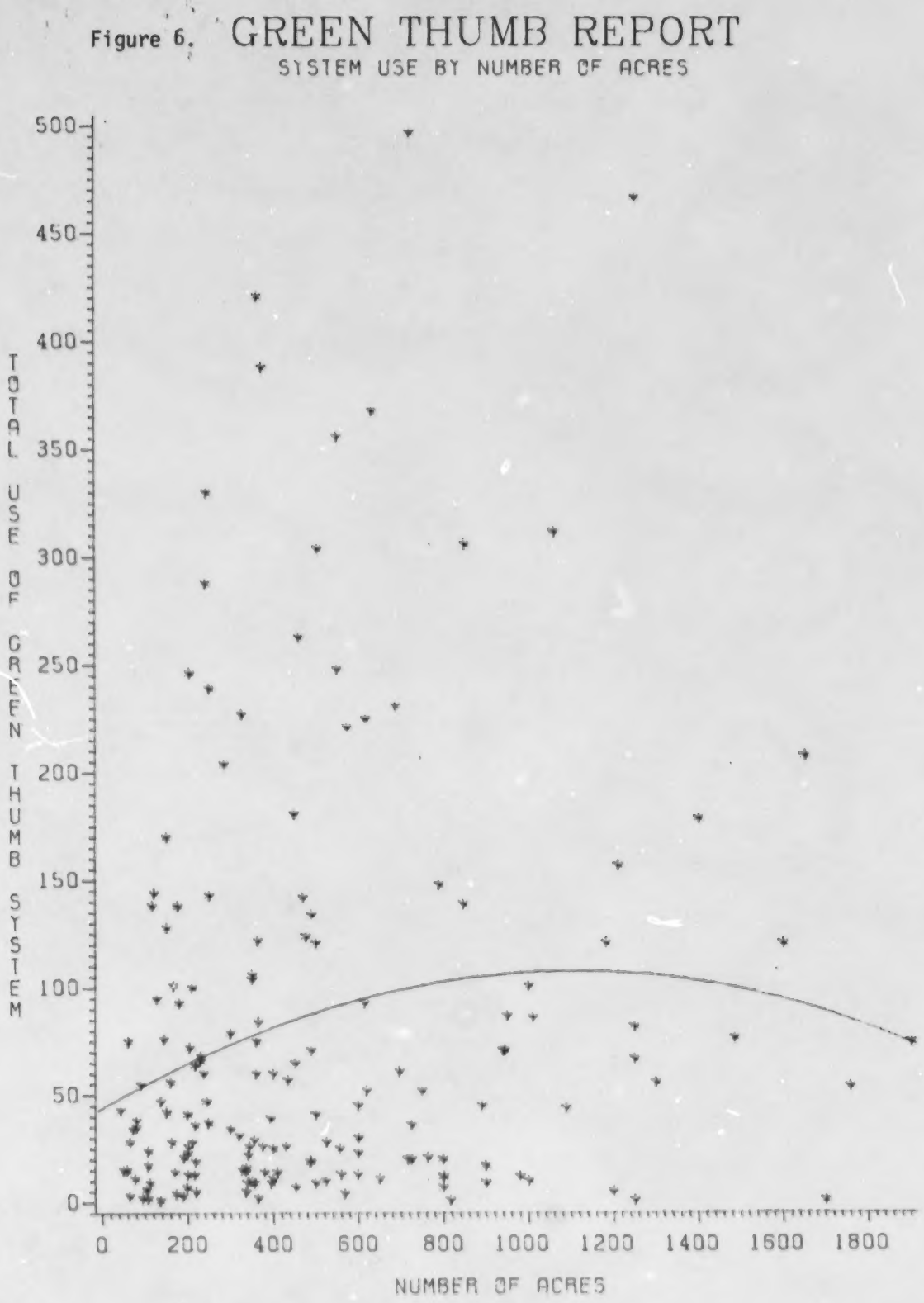
Chi square for total = 6.13 Significance = .190

f. Farm Sales

Finally, the last farm characteristic to be considered is the relationship between total farm sales and GT use. Table 14 represents this association.

Overall, the use of GT is not related to the amount of farm sales. The percentage in the high use category only varies from 30 to 40.

Figure 6.


GREEN THUMB REPORT
SYSTEM USE BY NUMBER OF ACRES
TOTAL USE OF GREEN THUMB SYSTEM
500
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
1800
NUMBER OF ACRES

Neither county shows a linear relation between the value of sales and use of the GT system.

Again, Todd County farmers use GT more than Shelby County farmers in every category. Greatest use in Todd County is for farms with sales of $20,000-39,999 and for the $40,000-99,999 category in Shelby County. It was expected that farms with greater farm sales would be higher users of GT, but that relationship was not found. Therefore, GT use must be related to factors other than the sheer magnitude of the farm operation.

TABLE 14. GT USE BY TOTAL FARM SALES

	Shelby			Todd			Total		
Farm Sales	(N)	High	Low	(N)	High	Low	(N)	High	Low
$1-$19,999	(10)	30%	70%	(7)	43%	57%	(17)	35%	65%
$20,000-$39,999	(8)	13%	87%	(5)	60%	40%	(13)	31%	69%
$40,000-$99,999	(24)	38%	62%	(6)	50%	50%	(30)	40%	60%
$100,000 and up	(22)	18%	82%	(24)	42%	58%	(46)	30%	70%

Chi square for total = 0.82 Significance = .846

2. Socio-Economic Characteristics of Farmers

In this section, socio-economic variables are examined in conjunction with GT usage. These variables are as follows: age, years in farming, education, family income, and percentage of income coming from off-farm sources. Previous research on acceptance of farming innovations leads to the expectation that younger, highly educated, affluent, full-time farmers who are relatively new to farming are more likely to be the highest users of GT.

a. Age

The first background variable examined is age. Table 15 shows the relationship between age and GT use for both counties.

Farmers under 35 years of age are the most frequent users of GT, though there is not a substantial difference between the groups. As mentioned above, research on age and acceptance of innovations indicates that younger farmers would be expected to accept and adopt innovations more quickly than older farmers. The findings reflect this tendency, but also indicate that Todd County farmers in the middle age range (age 35 to 50) are also high users. In fact, these farmers are the highest GT users of any age group. Interestingly, this same age group was the lowest user in Shelby County. Since high use occurs only in one county, the combined totals are somewhat misleading. It should be pointed out that there were more farmer participants in the older age group in Shelby County than in Todd, and, axiomatically, more farmers in the youngest age group from Todd County.

In a bivariate plot of this relationship (Figure 7), the least squares line is almost level. The line starts higher for the younger age group, descends slightly, and turns up in the older ages. This figure confirms that age was not a significant indication of usage.

TABLE 15. GT USE BY AGE OF FARM OPERATOR

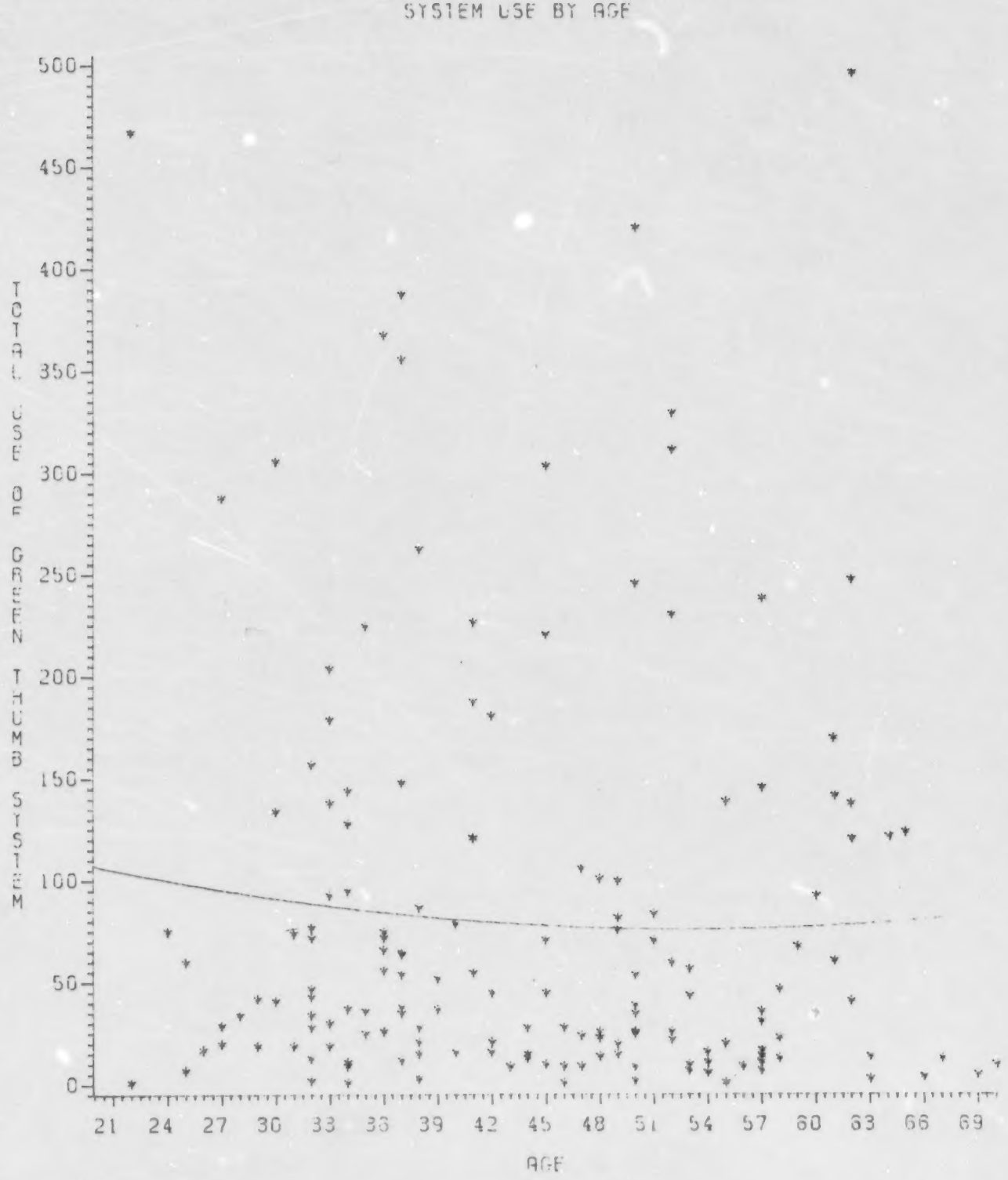
	Shelby			Todd			Total		
Age	(N)	High	Low	(N)	High	Low	(N)	High	Low
34 and under	(27)	33%	67%	(39)	41%	59%	(66)	38%	62%
35-49	(32)	19%	81%	(29)	52%	48%	(61)	34%	66%
50 and over	(32)	25%	75%	(25)	40%	60%	(57)	32%	68%

Chi square for total = 0.54 Significance = .763

b. Years in Farming

Somewhat unexpected usage patterns emerge when related to the length of time a user has been engaged in farming. From previous research one would hypothesize that newer farmers would be more likely to use GT. However, that pattern does not hold.

Figure 7. GREEN THUMB REPORT



As seen in Table 16, the greatest percentage of "high" users are the 11-20 year farmers. This relationship is present in both counties. Comparing usage percentages of the 1-10 year farmer with the 21 year and over farmer yields mildly surprising results. Normally, one would predict higher usage patterns for the less experienced farmer than for older ones. But this is not the case here. Twenty-eight percent of the newer farmers are "high" users compared to 31% of the veteran farmers.

Figure 8 plots the bivariate relationship of number of years in farming and usage. Like Table 11, it shows there was high usage by those farmers who have farmed from 11-20 years, but also indicates this pattern continued until 30 years of farming. After that, usage declines gradually. This illustration reinforces the observation that those relatively new to farming were low users of GT.

TABLE 16. USE OF GT BY YEARS IN FARMING

Years in Farming	Shelby			Todd			Total		
	(N)	High	Low	(N)	High	Low	(N)	High	Low
1-10	(34)	21%	79%	(31)	36%	64%	(65)	28%	72%
11-20	(14)	50%	50%	(22)	50%	50%	(36)	50%	50%
21 and over	(40)	20%	80%	(34)	44%	56%	(74)	31%	69%

Chi square for total = 5.56 Significance = .062

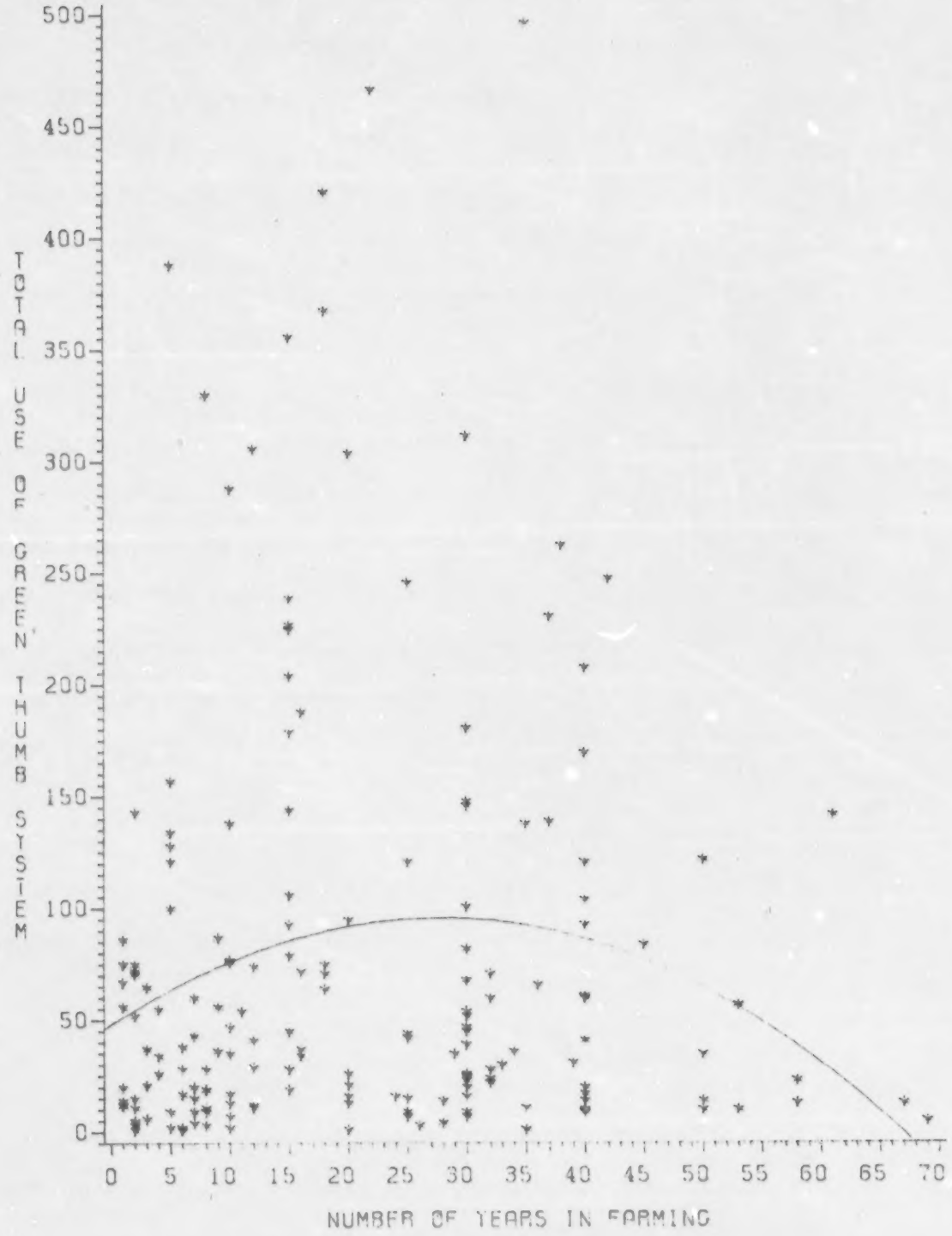
c. Education

Educational background also shows an unexpected association with GT usage. One would anticipate that highly educated farmers would use GT more than those with less education. Examining Table 17 reveals quite a different result.

The percentage of "high" users in both counties shows that those with less education were the most frequent users, and suprisingly the most educated farmers, those with some graduate school training or a graduate degree, comprise the lowest users. Farmers having a

Figure 8. GREEN THUMB REPORT

SYSTEM USE BY NUMBER OF YEARS IN FARMING



high school degree are the highest GT users and those with less than a high school degree are the second highest users. Those with graduate training are the lowest user category with 94% using GT less than twice per week. An unexpected county difference is the higher number of Shelby County farmers with some graduate work or a graduate degree. This becomes a factor in accounting for differences between the counties, since only 3% of the farmers in Todd County compared to 15% in Shelby County are in the most educated category.

Interpretations of this table could proceed in different directions. On the one hand, GT is an information dissemination system which is unlike mechanical innovations (e.g., harvesting equipment) or technique oriented innovations (e.g., double cropping). Therefore, because of its uniqueness, it may not follow diffusion patterns of previous innovations. A second possibility is that farmers with higher educations may have used the system less due to dissatisfaction with the limited capabilities of GT and the desire for a more sophisticated system with better reliability. A third explanation may be that these highly educated persons are Shelby County residents that have a primary job off the farm and do not have a strong commitment to farming.

This third explanation is substantiated since 69% of those having some graduate training or a graduate degree worked more than 100 days off the farm. Similarly, 92% of them received over half of their income from off-farm sources. In contrast, the highest use category was farmers who completed high school. Controlling for these same variables showed the opposite results: 85% worked less than 100 days off the farm and 67% received the majority of their income from the farm. Thus, a farmer's education was closely related with whether they were full or part-time farmers.

TABLE 17. USE OF GT BY EDUCATIONAL LEVEL

Education	Shelby (N)	Shelby High	Shelby Low	Todd (N)	Todd High	Todd Low	Total (N)	Total High	Total Low
Some HS or Less	(16)	25%	75%	(23)	43%	57%	(39)	36%	64%
Completed HS	(25)	40%	60%	(35)	46%	54%	(60)	43%	57%
Some/Grad. College	(36)	25%	75%	(33)	42%	58%	(69)	33%	67%
Grad Work or Degree	(14)	0%	100%	(2)	50%	50%	(16)	6%	94%

Chi square for total = 7.76 Signficance = .051

d. Family Income

Family income (before taxes) is the next variable considered (Table 18). When examining usage for both counties it is surprising to find that the highest usage was by the lowest income group (under $15,000). In Todd County, differences between the lowest and highest income brackets are negligible, whereas in Shelby County the low income category is clearly the highest user group. It should be pointed out that there are substantially more Todd County farmers in the lowest family income category than in Shelby.

These above findings do not match the expected results based on previous innovation work, however, family income is influenced by income from off-farm sources. Families with lower incomes work less time off the farm and, therefore, are more dependent upon the farm for its contribution to the family well-being. This could provide more time and reason for effective information utilization.

TABLE 18. USE OF GT BY LEVEL OF FAMILY INCOME

Income	Shelby (N)	Shelby High	Shelby Low	Todd (N)	Todd High	Todd Low	Total (N)	Total High	Total Low
Under $15,000	(24)	38%	62%	(49)	45%	55%	(73)	42%	58%
$15,000-$34,999	(32)	28%	72%	(17)	35%	65%	(49)	31%	69%
$35,000 or more	(35)	14%	86%	(27)	48%	52%	(62)	29%	71%

Chi square for total = 3.18 Significance = .204

e. Percentage of Income From Off-farm Sources

The last association considered in this section is the relationship of GT use to the percentage of income from off-farm sources. This data is presented in Table 19.

This indicator may be the most predictive variable, in that the greater the percentage of off-farm income, the less those farmers use GT. If a farmer receives at least half of his income from agriculture, he is much more likely to use GT. This finding suggests that farmers who are engaged in farming on a full-time, or almost full-time basis, are more likely to seek out information such as can be found on GT. This indicator could be seen as the farmer's commitment to farming.

Again, county differences are to a great extent reflective of the different nature of farming in the two counties. Shelby County has many more farmers with substantial off-farm income with relatively low usage.

Livestock farmers tend to work off the farm more than crop farmers, while the operators of mixed commodity farms tend to either derive a large proportion of their income from off-farm employment or they depend upon off-farm income very little.

TABLE 19. USE OF GT BY OFF-FARM INCOME

Off-Farm Income (percent)	Shelby (N)	Shelby High	Shelby Low	Todd (N)	Todd High	Todd Low	Total (N)	Total High	Total Low
0-25%	(14)	36%	64%	(22)	45%	55%	(36)	42%	58%
26-50%	(12)	25%	75%	(7)	71%	29%	(19)	42%	58%
51-75%	(7)	29%	71%	(3)	0%	100%	(10)	20%	80%
76-100%	(24)	17%	83%	(8)	0%	100%	(32)	13%	87%

Chi square for total = 8.82 Significance = .032

3. Summary of Bivariate Relationships

The striking fact about the discussion on the relationship of the characteristics of farms and farm operators to GT use is that only one variable, percentage of income from off-farm sources, was statistically significant at the .05 level. Two other variables, years in farming and education, are just above this significance level. However, in the former, farmers in the 11-20 year bracket, not newer farmers, used GT the most. Similarly, education showed a difference in use, but in a direction opposite from the expected relationship, that is, the results were that the higher the education the less GT use. Other than these farm operator characteristics, no other background variables, nor farm characteristics, had a strong directional relationship with usage.

However, as stated throughout, a consistent county difference was evident; Todd County farmers used GT more than farmers in Shelby County. These county differences are interrelated with differences in farm characteristics; for example, 88% of the crop farmers and 78% of the farms of 1,000 or more acres were located in Todd County. Both crop farmers and farmers working large acreages were by far the highest GT users.

Socio-economic differences of farmers in the two counties also seemed to have an effect on GT use. One outstanding difference concerned off-farm income. Out of those farmers who earned over half of their income from off-farm sources, 74% were Shelby County farmers. Although education was related to GT use, its importance was also evident by its relationship with other variables. Shelby County farmers in this test had higher educations, worked more days off the farm, had higher family incomes, and received a higher percentage of their income from off-farm sources than did Todd County farmers.

Nevertheless, county differences cannot be fully explained by user characteristics. As we saw in chapter IV, operational problems affected Shelby County much more than Todd County. Consequently, location alone may also have been an important factor in this test.

4. Multivariate Analysis

Multivariate analysis of the data did not yield significant results, nor did it explain much of the variance in the dependent variables. Rather, it served to confirm the findings of the bivariate analysis, that is, the relationship between background variables were neither strong nor, in the majority of cases, in the expected direction.

Multiple regressions were run for two dependent variables against a total of ten independent variables. The dependent variables were use, the actual number of times GT was used over a thirteen-month period (April 1, 1980 to April 30, 1981), and the farmer's expression as to his or her willingness to pay for a GT-type system if offered in the future. The independent variables were as follows: number of acres, years in farming, county, type of farm, education, age, family income, number of days the spouse worked off the farm, number of days the farmer worked off the farm, and percentage of income coming from off-farm sources.

Table 20 is a matrix representing Pearson Correlations of all the variables included in this analysis. Of all these associations, the county they lived in was the only variable related to usage that was significant at the .05 level. Whereas no variables were significantly related to willingness to pay.

Table 21 shows the results of forward stepwise multiple regressions. They were run two ways. The first set was an attempt to determine which independent variables were most likely to explain the variance of the dependent variables. The second set was exploratory, in that, it included the variables--number of days the spouse and the farm operator worked off the farm, percentage of income coming from off-farm sources, and total acres farmed. This was an attempt to represent a farmer's general commitment to farming.

Although the independent variables are not explaining much of the variance for use and willingness to pay, this too is revealing. If these models would have fit general expectations, then those with higher incomes, education, and acreage, as well as those who were younger and new farmers would have been higher users and more willing to pay for this innovation. The findings did not follow those expected patterns and suggests that the introduction of this technology may not follow the traditional adoption model. A GT-type information system is different than other examples of innovative farm practices in that it draws upon the existing technology of the telephone and television that are already widely accepted, it is easy to use and understand, it was free during the test period (and is likely to be a low-cost item in the future), and it carries with it the excitement of electronic gadgetry.

TABLE 20. CORRELATION COEFFICIENTS[1]

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Use	1.000 (194)												
(2)	Willing To Pay	.093 (157)	1.000 (162)											
(3)	Farm Size	.093 (169)	.099 (146)	1.000 (173)										
(4)	Farm Type	.016 (164)	.104 (138)	-.116 (155)	1.000 (165)									
(5)	Farm Sales	-.103 (105)	.005 (87)	.613* (101)	.098 (106)	1.000 (106)								
(6)	Years In Farming	.031 (176)	-.130 (151)	-.040 (169)	.068 (161)	-.041 (104)	1.000 (180)							
(7)	County	.216* (186)	-.062 (160)	.244* (173)	-.260* (165)	.267 (106)	-.002 (180)	1.000 (190)						
(8)	Education	-.079 (179)	-.051 (153)	-.096 (170)	.016 (162)	-.074 (106)	.019 (178)	-.200* (183)	1.000 (183)					
(9)	Family Income	-.083 (140)	-.073 (116)	-.024 (132)	-.094 (139)	.002 (101)	.075 (138)	-.119 (141)	.046 (141)	1.000 (141)				
(10)	Age	-.020 (184)	-.121 (158)	-.102 (173)	.013 (165)	-.084 (106)	.493* (180)	-.096 (188)	-.032 (183)	.109 (141)	1.000 (188)			
(11)	Income Off-Farm	-.145 (127)	-.105 (112)	-.350* (123)	.041 (114)	-.172 (83)	-.010 (128)	-.281* (131)	.393* (131)	.103 (105)	.166 (131)	1.000 (131)		
(12)	Operator Off-Farm	-.088 (164)	-.032 (141)	-.314* (156)	.045 (152)	-.139 (99)	-.191* (164)	-.207* (168)	.388* (166)	.077 (132)	-.012 (168)	.617* (119)	1.000 (168)	
(13)	Spouse Off-Farm	-.029 (158)	.014 (134)	-.053 (147)	.025 (156)	.033 (102)	-.036 (154)	-.104 (159)	-.075 (158)	.028 (136)	-.059 (159)	.072 (111)	.233* (145)	1.000 (159)

*Significant at the .05 level

[1]Three variables were treated as dummy variables and coded as follows: County - Shelby = 0, Todd = 1, Farm type - Specialized = 0, Mixed = 1, Willing to Pay - No = 0, Yes = 1.

TABLE 21. MULTIPLE REGRESSIONS

Dependent Variable	Explained Variance (R^2)	Independent Variables Entered The Model In The Following Order Of Importance:	N
Use	.09	1. Education* 2. County* 3. Farm Type* 4. Family Income 5. Age 6. Years Farming 7. Total Acres	123
Willingness To Pay	.11	1. Years Farming 2. Education* 3. Farm Type* 4. Total Acres 5. County 6. Family Income 7. Age	103
A second set of independent variables were regressed with the following results:			
Use	.03	1. Percentage of income from off-farm sources 2. Number of days spouse worked off the farm 3. Number of days farmer worked off the farm 4. Total acres	92
Willingness To Pay	.04	1. Total acres 2. Number of days farmer worked off the farm 3. Number of days spouse worked off the farm 4. Percentage of income from off-farm sources	78

*Significant at the .05 level.

E. Information Requests by Farm Type and Size

1. General Information Types

This section categorizes the type of information requested by the various types and sizes of farms. Three general categories of information, market, weather, and extension information are presented in Tables 22 and 23. These tables show the average amount of information accessed by individuals in the various categories.

Table 22. Average Number of Requests by Category of Information and Farm Type

	Crop (N=45)	Mixed (N=99)	Livestock (N=20)
Market	256	168	70
Weather	93	115	61
Extension Information	31	55	30

Crop farmers accessed market information far more frequently than any other farm type. This appears directly related to their ongoing concern with changes in grain prices.

Mixed farmers also were interested in the marketing category, probably as a result of the crop portion of their farm. Crop and mixed farmers were about equally interested in weather information, with the mixed farmers having the highest average. This is probably a result of a mixed farmers' need of weather information for both the crop and livestock portion of

their farming operation. Extension information was also accessed most by the mixed farms. Again, this appears to be related to the fact that these farmers require a wider variety of information to run their farm. In all three categories, the livestock farmer averaged the least number of requests. As a speciality farm, they do not have the same needs as crop farmers, especially for marketing information.

Table 23 presents the categorical breakdown of information by farm size.

Table 23. Average Number of Requests by Category of Information and Farm Size

	1-299 acres (N=55)	300-599 acres (N=53)	600 and over (N=47)
Market	102	166	298
Weather	95	116	103
Extension Information	45	49	43

The only informational category demonstrating a difference was marketing. Marketing requests show a linear pattern with farmers on smaller farms accessing the least number of frames, the larger farms the most, and the middle-sized farmers falling between the extremes. These larger farms are, in all liklihood, crop farmers who, as stated previously, have a strong interest in marketing information. In contrast, weather and extension information were accessed about the same number of times regardless of farm size. This latter finding indicates that GT

information, in general, served farmers on all sized farms.

2. Marketing Information

Market information was subdivided into the following categories: futures market, market interpretation, regional prices, information from the Agricultural Marketing Service, and specialist information from the University of Kentucky. Tables 24 and 25 present the use of various types of marketing information by farm type and size.

Table 24. Average Number of Requests by Type of Market Information and Farm Type

	Crop (N=45)	Mixed (N=99)	Livestock (N=20)
Futures Prices	193	115	42
Market Interpretation	47	17	11
Regional Prices	5	20	10
AMS Information	3	7	2
Specialist Information	7	8	4

Futures prices and market interpretations were requested more frequently by crop farmers than any other group. Mixed farmers were also frequent users of the same information but on a lower scale than were crop farmers. In contrast, livestock producers were low users of both of these informational categories. Mixed farmers averaged the most requests for regional prices, AMS, and specialist marketing information. Livestock farmers, although low users in most categories, accessed a relatively

high number of regional prices. These livestock and mixed farms tend to represent medium size farms.

Table 25 presents the type of market information by size of farm.

Table 25. Average Number of Requests by Information and Farm Size

	1-299 acres (N=55)	300-599 acres (N=53)	600 and over (N=47)
Futures Prices	60	113	233
Market Interpretation	18	19	44
Regional Prices	10	21	10
AMS Information	8	6	4
Specialist Information	7	7	8

These figures are similar to the previous table, in that, large scale farms, in most cases crop farmers, made more extensive use of futures prices and market interpretation. What is found is that although futures prices were most frequently accessed by large scale crop farmers, regional cash prices were more frequently requested by operators of medium-sized, mixed farms. Additionally, even though AMS information was only available for six months, two patterns were evident: 1) it was accessed a fair amount, and 2) small and medium size farmers were more frequent users. Market information provided by specialists was used equally by all farm sizes. The pattern of usage of regional cash prices suggests the need for local prices to be included in future

GT-type systems. This would increase the benefits for the small and medium sized farmer, in as much as they are more likely to sell their commodities locally. The large crop farmer, however, would continue to be served through the provision of futures prices.

F. Limitations of the Data

Caution should be used in generalizing too much from the findings of this study. This test was carried out under a very specific set of circumstances. GT was a pilot project with a relatively small number of users over a limited period of time. Inasmuch as the service was free during the test period, users had little more than their own time invested in GT. Therefore, there was little or no risk-taking. The innovation was also made available to different types of farmers at the same time. Those farmers selected for the GT test participated, at least in part, through self-selection. In addition, use by certain individuals, especially those in Shelby County, was affected by technical malfunctions. Though these farmers represented most of the sizes and types of farms in the two counties, it was never intended that they would be truly representative of all farmers, or even all farmers in the two counties. Because GT users volunteered to participate in the program, it could be argued that this group would be expected to be more innovative than would a cross section of all farmers. The Stanford study classified GT users on the basis of their adoption of ten innovative farm practices. Figure 9 presents the distribution of GT farmers on the basis of a combined index of those practices. If the indicators truly differentiate degrees of innovativeness, then at any one point in time one would expect a normal distribution among farmers. As can be seen, GT users closely approximated such a normal distribution. Therefore, it can be concluded that GT users exemplified the full range of farmers with respect to innovativeness as indicated by those ten practices.

Even with limitations, GT has provided one of the first field tests of this technology. It provides insight into the many policy issues from

the perspective of the delivery system, the information provider, and the user. Though it is far from the ultimate test, it does contribute a wealth of information in the form of experiences, observations, reactions, and attitudes about this new technology. Only a limited amount of information can be obtained through market studies and laboratory tests, then it is necessary to "jump in" and see what happens. GT did just that. Now it is important to examine carefully the results of the test and to suggest the implications for future systems.

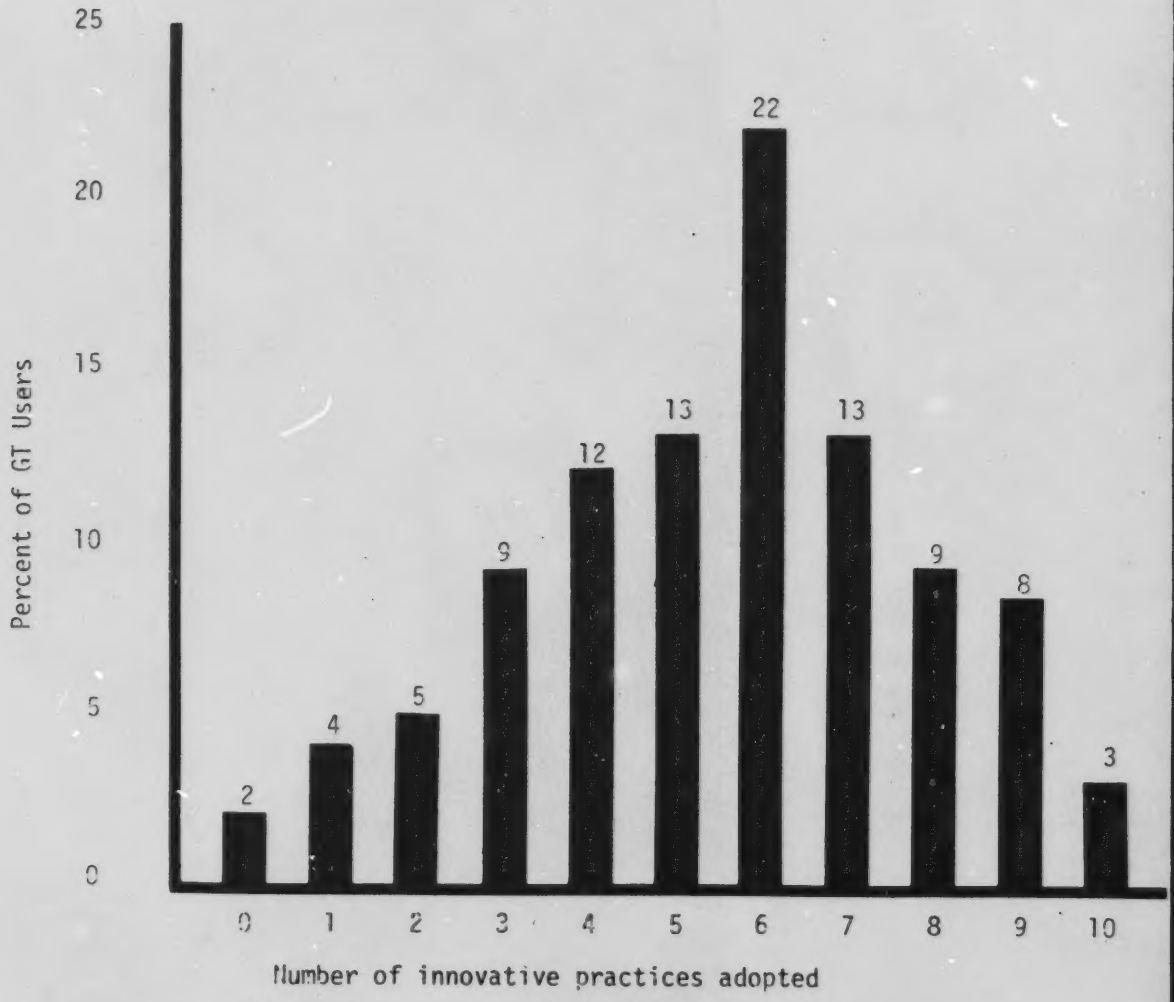


Figure 9. Distribution of Innovativeness of GT Users

G. Generalizations

1. The number of calls into the GT system declined substantially over the life of the test (from over 5,000 calls per month at the start down to just over 1,000), though the level was consistently higher in Todd County than in Shelby.
2. Over the 13-month test period, 35% of the users called GT on an average of two times or more per week; in Todd County it was 44% and Shelby had 25%.
3. Only a third of the farmers were still using GT at the end of the test.
4. On the average, users requested 4.2 information items per call.
5. Together, weather and market items represented 86% of the requests.
6. Soybean futures was the single most used item.
7. Weather items were called most in Shelby County; whereas, in Todd County market information was the most frequently requested.
8. Times of peak use were from 11 a.m. to 2 p.m. and from 5 to 8 p.m.
9. For the average call, the transmission time from the county computer to the GT box was 1 minute and 48 seconds.
10. Calls during mid-day were shorter and for fewer items while in the evenings and mornings users requested more frames per call thus resulting in longer transmission times.
11. Updating of both the automatically and manually entered information was generally less frequent than was originally scheduled.
12. Crop farmers most frequently accessed GT information, followed by mixed farms and then livestock farmers.
13. Usage by farm size was fairly constant until the category of 1,000 acres or more, in which the proportion of high users increased substantially.

14. There were no significant differences in usage by total farm sales.
15. Though the differences are small, younger farm operators were more frequent users.
16. Farmers who had farmed from 11 to 20 years accessed GT information more frequently than those who had farmed more or less years.
17. The only significant difference in use by the educational level of the operator was that those with graduate training accessed the information the least.
18. The higher the family income the less these farm families used GT.
19. Those farmers who secured more than half of their incomes from non-farm employment were less likely to access GT information.
20. Only 9% of the differences in GT use and 11% of variation in willingness to pay for the service can be explained by the operator and farm characteristics examined.
21. Some aspects of the GT database were of use to all size and type farms.
22. Large scale crop farms accessed market information the most, expecially futures prices and market interpretations.
23. Regional cash prices and information provided by AMS were requested slightly more by small and medium sized farms. This pattern of use suggests the need for local prices to be included in future GT-type systems.
24. Mixed farms tended to access weather and Extension information more frequently, probably due to their need for a wide variety of information for both the crop and livestock portions of their farms.
25. Weather and Extension information were accessed at about the same frequency by all farm sizes.

H. Recommendations

1. The number of frames on the system should be reduced to those which show a moderate degree of use, thus allowing for more frequent updating of the remaining frames.
2. Farmers used the system so infrequently in the late evening to early morning period (midnight to 6 a.m.) that there seems to be very little demand for a twenty-four hour service. Therefore, shutting the system down during low-use periods would reduce personnel costs and possible system malfunctions.
3. Since livestock farmers made the least requests for GT information, CES administrators in geographic areas where livestock production predominates should question whether this type of information service would be utilized by such farmers in their regions.
4. Based on the results of this test, adoptors of computer technology may not be restricted to large, innovative farms as one would predict. Consequently, administrators making a GT-type system available to farmers in their state need to recognize the variety of needs of these different size and type farms.
5. Providing grain futures prices on a future GT-type system would primarily serve large scale crop farmers, while providing regional and local cash prices on grain and livestock would serve the needs of small and medium sized farmers.
6. CES administrators should determine if needed marketing information can be secured from the Agricultural Marketing Service.
7. Agricultural economics specialists should provide interpretational information on market changes and conditions.

VI

INSTITUTIONAL CONSIDERATIONS

The University of Kentucky College of Agriculture is a land-grant system with a tripartite mission that includes the functions of research, instruction, and public service. The Cooperative Extension Service is the public service arm of the College. It is administered by the Dean of the College, an Associate Director for Extension, and Assistant Directors of the different program areas. The College is composed of 10 academic departments in which are officed about 100 state subject-matter specialists that support the Extension program in the areas of agriculture, home economics, 4-H youth, and community development. In addition, County Extension Agents are officed in all 120 counties of the state, with a typical county having three agents - one each in agriculture, home economics, and 4-H.

Extension is an important part of Kentucky's $3 billion agricultural industry. Innovative programs such as no-till planting, double-cropping, farm business analysis, and Integrated Pest Management have been important contributions of the Extension program. An integral part of the adoption of new technology in Kentucky agriculture has been the introduction of computers for use in farm decision-making. In 1978, the College of Agriculture established the ANSER network that includes programs or such topics as grain drying and storage, least-cost livestock rations, farm management and planning, fertilizer recommendations, and budgeting. Such a system makes available the use of computers for providing farmers with decision-making alternatives for their specific situations at a fraction of time previously required by traditional methods.

The Green Thumb project operated at the University of Kentucky Extension service on three levels; the administrative, the state specialist and the county. This section of the report considers the daily operation of GT in each of these areas by documenting the experiences of personnel working on the project and analyzing the impact it had on the organization of Extension. Since it is unlikely GT will be recreated in its present form, it is also necessary to project ahead to specific recommendations and generalizations related to future computer-based delivery systems.

Part one highlights the experiences of administrators by considering their roles as managers and coordinators of Green Thumb. Parts two and three analyze the activities of specialists and county personnel with respect to the organization of their GT entries, the informational requirements of GT, and the human-computer interface. Other considerations in all three sections include time spent on the project, modification of travel patterns, staffing requirements, role changes and the appropriateness of incorporating a computer-based delivery system into Extension organizations.

A. Administration

Administrators at the University of Kentucky who worked on setting up and managing Green Thumb were the project director, the chairman of the coordinating committee, the director of public information, and the area directors for Todd and Shelby Counties. In-depth interviews with all but the area director from Shelby County (he transferred after the project began) provide a major portion of the information presented in this section. Other sources of information include 1) interviews with GT coordinators as well as technical personnel who acted as contacts with outside organizations

and 2) direct observations by the evaluation team. The administrative activities that were considered were: goals, liaison with vendors, hardware and software management, coordination of specialists and agents, time spent on GT, and other administrative considerations.

1. Goals

The general purpose of the project for administrators was twofold: 1) to test the technical feasibility of relaying agricultural information to farmers via computer networks and 2) to determine farmers' acceptance of information disseminated in this manner. Before the test began and in its first few months, administrators expanded their aspiration to provide a fully functional information service. This aim gained further momentum after the equipment operated smoothly in the opening months of the project. The expectations of everyone soared during this time. Administrators and specialists told farmers to expect market updates every fifteen minutes, and specialists and county agents devised plans for providing different types of information quickly to the farmers. The computer records indicated farmers accessed GT frequently during this starting period. Some farmers came to expect and depend on GT information.

Hardware problems were the first difficulties encountered by the GT system. These problems led to a ripple of other problems such as outdated information and data entry difficulties, which stemmed from limited resources both in terms of equipment and staff. At the administrative level, the management of a completely unfamilar technology strained the capacities of a busy staff. The challenges administrators faced just to keep the system up and running persuaded them that, given the resource limitations, a fully functional, reliable system would be difficult to maintain. Administrators

realized everyone's expectations were unrealistically high and, by definition, a pilot project was an opportunity to break new ground and learn from one's mistakes. Some modifications were made during the test, but problem awareness was often not enough; adjustments in the system were limited by overloaded equipment, overworked staff and unresolved technical problems, some of which were provoked partly by financial constraints.

2. Liaison with Vendors

Financial limitations dictated that the project director use existing university equipment or select reasonably priced hardware and software. Basically, this meant the various components of GT would be equipped and maintained by existing UK equipment and others would be supplied by a variety of vendors. The result was the following list of vendors and their affiliated service departments serving GT.

VENDOR	PRODUCT
* Motorola	- Green Thumb Boxes
* Western Union Telegraph Co.	- County Micro Processors
* Hewlett Packard	- State Computer
* Grumman Data Systems	- Software Connections
* South Central Bell Telephone	- Communication Lines
* General Telephone	- Communication Lines
* Racal-Milgo	- Linkage for the State Computer and County Micro Processors
* Racal-Vadic	- Dial-up equipment for the State Computer and the direct line for the market wire
* Nu-Data	- Linkage and Modem for the State Computer
* Micom	- Concentrators between the State Computer and County Micro Processors

To this list, the following information providers who supplied data to GT must be included.

INFORMATION PROVIDER		INFORMATION
* Agricultural Marketing Service	-	USDA Market Information
* American Quotation Service (up until January 1, 1981)	-	Commodity Futures Prices
* Commodity News Service (after January 1, 1981)	-	Commodity Futures Prices
* National Weather Service	-	Weather

Thus, when the two lists are added together, fourteen different companies or institutions served GT. As would be expected with any new system, there were problems with hardware and software, resulting in problems with informational updates. Over the course of the test, the reasons and responsibilities for the problems varied a great deal. In many cases, the cause of such malfunctions could not be readily determined by UK administrators and technical personnel. Furthermore, since these hardware and software linkages were first made in this project, vendors were also often perplexed concerning the causes of some malfunctions. This situation led to a classic case of diffusion of responsibility; that is, vendors or providers disclaimed responsibility for a breakdown, or they blamed it on another link in the system. Consequently, some organizations responded slowly to calls for assistance. An obvious solution would be to use as few vendors as possible (preferably one) to supply and service the equipment.

Three additional factors affected vendor liaison: 1) The Director of the Ag Data Center, who had served as the technical specialist for the project, left the University early in the project. His duties were distributed among existing staff. In the process, much knowledge of how systems interacted was lost. 2) GT sometimes had more than one person contacting the same vendor or information provider and 3) service providers often had different people

responding to GT representatives. These factors, in addition to the variety of organizations serving GT, further contributed to the complex network of contacts; thus, dispersing responsibilities among vendors, information providers and the university staff to an even greater degree.

From the perspective of the administration, one reason this dispersion of responsibility occurred with GT was that the project director had considerable demands on his time and had limited amount of time to work directly with outside organizations. Out of necessity, various staff members were encouraged to perform this role when it meshed with other project duties. This did not work well because they all felt they lacked the necessary expertise and some felt they lacked authority in these transactions. Ideally, one individual with authority and experience in hardware and software technology should be the sole liaison with vendors and informational providers. Because there are two sides to every coin, however, many problems would be alleviated if only one vendor provided hardware, software and service for the entire system. An additional recommendation is that any company involved in a future system provides (a) counterpart(s) to the University administrator. In this way, chances are better that problems would be dealt with quickly and competently.

3. Hardware and Software Management

In the acquisition and management of GT hardware and software, the project director's duties were numerous. He set up an industrial conference to obtain insight into the state of technology in the computer field and its possible application to a GT-type system; he chaired a technical committee whose function was to assess hardware and software specifications; he convened a second industrial conference with all interested companies

to review those specifications: he worked with the UK Purchasing Department in the solicitation of bids; chaired the committee that selected vendors; and, finally, he assembled those vendors to review the overall design of the system. Obviously, it took a great deal of time to accomplish these tasks.

After initially purchasing the equipment, no major hardware changes were made, however, minor repairs were oftentimes required. These repairs were coordinated by GT staff. In the case of overseeing repairs of GT boxes, the project director delegated this task to the GT marketing research assistant. For the state equipment, the head of the Agriculture Data Center came to assume this responsibility; while the two county agents were stewards of the county equipment.

Aside from hardware repairs, software modifications were also necessary. Both software changes and the process underlying these changes are important to consider here. Determination and discussion of software changes took place at the GT Advisory Committee meetings. These meetings involved administrators, specialists, county agents, evaluation personnel, UK technical staff, and farmers. Changes agreed on by this committee were, when possible, implemented by the staff of the Agricultural Data Center or Grumman personnel. One example is the alteration of the "greeting page" (the opening screen for each session). The software was designed so that the greeting page remained on the screen while information was being transmitted to the GT box. Originally, this screen displayed only the U.K. College of Agriculture logo, which, because of its repetition, bored farmers and county agents and did not present any information. The Committee agreed this screen should be used to present local information. At the request of the project director, the greeting page was reformulated, allowing the two county agents to enter local items of interest. The greeting page was later changed into an alert page. The future plans for the alert page is to use text messages on the first page of every session to capsulize quick-breaking information

(e.g., an outbreak of army worms in Southwestern Kentucky). Aside from the short messages, references to other GT frames and/or publications can provide users with the means to retrieve more detailed information (e.g., consult Frame 121 for measures to take to exterminate army worms, or see Entomology Newsletter Vol. 15, No. 2 at your County Agent's office). An important point is that the expression of the need for change originated with users, was considered by the staff of the project and then was implemented by the project director. A similar process occurred with specialists and is elaborated in the next section.

By contrast, some software changes were made with only minimal administrative coordination. Some problems occurred because of the way software was originally written. The Senior Programmer at the Agricultural Data Center was the only person on the GT staff who was qualified to identify these problems. He corrected them either by requesting assistance from Grumman Data Systems or by rewriting programs himself. Because of the complexity of the problems, administrators could do little more than encourage Data Center personnel to work on them. No computer programmers were dedicated solely to GT.

4. Coordination of Specialists

Before GT was operational, the project director, the Assistant Extension Director for Agricultural Programs, and the departmental chairmen selected specialists to serve as GT departmental coordinators. These individuals were asked to serve in this role because of their experience and interest in the computer field. These thirteen individuals from the various departments were then asked to organize their departments' input to GT.

Aside from coordinating their departments' entries, these specialists represented their departments at the GT Advisory Committee meetings. The Coordinating Committee, chaired by the Assistant Extension Director for Agriculture, generally met once every month for two hours. The county

agents from the two test counties also participated in these sessions. In addition, they brought users along with them. In the case of Shelby County, the same two farmers came to most of the meetings. However, there was also variation at the sessions since a different set of farmers and spouses from Todd County attended each meeting. The first group provided consistency, while the rotating groups added new perspectives.

From this assortment of people, frank, wide-ranging discussions usually emerged. The tenor of these sessions were informal and nonthreatening. These gatherings provided a format where participants made suggestions and provided both positive and negative feedback. When changes were proposed, discussions followed, sometime leading to an informal group concensus and subsequent changes.

Two examples of this process of change are illustrative. First, farmers complained that the three-to-five day weather forecast, written as a text message, was difficult to comprehend. After this complaint was raised, the Committee generally agreed that this was the case. Soon after this meeting, the staff at the Ag Weather Center divided the frame's format into a grid pattern, which provided more information in an abbreviated form. Everyone agreed that this was a substantial improvement. A second example concerned complaints of sloppy formating and spelling mistakes on some frames. After farmers pointed out these problems, specialists began taking greater editorial care in the information they entered.

The informal nature of these meetings had some negative aspects as well. They were democratic to a fault; administrators provided little guidance on several important issues. For example, there was never a specific recommendation on how often to update frames. As it turned out, update scheduling was left entirely to each specialist. Moreover, no concerted effort was made to coordinate GT information across department lines. This is not a unique situation in GT, since this is a reflection of a more general

problem of lack of coordination across disciplinary lines. Still, some method for coordinating information needs to be designed for future systems (see "Other Considerations" in this section).

In addition to the lack of discussion of some items in these meetings, other topics were brought up, discussed but never resolved. In part, this occurred because no formal decision-making process was established in the committee, which, on the other hand, was probably a major reason why the meetings were nonthreatening. An example concerned using Public Information to edit and enter information onto the system. Dissension from some specialists, who thought it would slow up the entering of their information, left this issue in a state of limbo. As it turned out, not utilizing Public Information was probably a mistake. Specialists could have used editorial assistance. They had difficulties entering their own information because they lacked sufficient staff support, and the dial-up telephone lines into the state computer oftentimes were busy.

Maintaining an alert page will be important not only in terms of providing more attention for timely information, but it will also be the first step in transferring responsibilities for entering information from each specialist to a central entry point (Public Information). That office would need to hire an editor who, in addition to coordinating alerts, would edit all GT information. We see both the alteration in the greeting page and the use of an editor as needed changes. Moreover, we would propose additional recommendations in connection with the editor's position. Thus the editor would:

* work full time on GT;
* have a varied background in the areas of agriculture, journalism, and communications as well as some familiarity with computer-based information systems;
* encourage the development of interdisciplinary information;

* monitor GT information so that duplicate or contradictory messages would not be put on the system;
* assist the specialist in the improvement of format and display;
* contact specialists if their information is out-of-date and either update or delete such items.

In addition to an editor, this department would also need a graphic translator who would work with specialists to translate their ideas into two dimensional drawings, charts, graphs, maps and so on. Including these additional personnel into GT would simultaneously serve the administrative functions of monitoring specialists' contributions and coordinating interdisciplinary efforts. Additionally, these two staff members would improve the clarity and display of the information.

Complaints by some specialists were directed at lax training procedures concerning how to enter information on the state computer. Three specialists mentioned this as a problem. In the pre-operational stage, both administrators who set up training sessions and personnel who taught the procedure felt they adequately covered this (relatively simple) topic. It is easy to agree with them when one considers that the majority of specialists had no problem. However, in any new technology, some individuals need more guidance than others. Therefore, it seems reasonable to devise a follow-up training procedure.

5. Time Spent on the Project

Administrators who spent the most time on the project were the project director, the chairman of the GT Coordinating Committee, and the two area directors. The area directors attended preoperational and monthly coordinating meetings at the University as well as GT county meetings. Just before the project became operational, they worked with agents and university personnel at their respective counties testing GT equipment, training farmers, and distributing GT boxes. They also helped coordinate the activities of

personnel in the county Extension office. After the system was operational, they had few administrative functions connected to GT and spent very little time on the project's actual operation. A fair estimate of the total time they spent on GT is 5%.

Unlike the area directors, the Assistant Director for Agriculture's time was spread evenly in the preoperational and operational stages of the project. Although he performed some public relations activities, he was largely responsible for chairing the monthly coordinating meetings. He reported that about 5-10% of his total time was spent on GT activities.

The GT Project Director judged that 45% of his total time had been spent on GT from September, 1978 to April, 1981. Of that amount, approximately 50% was divided between the preoperational stage and the operational stage. His activities in both these periods have been previously discussed. The remaining 50% of his GT time was spent on public relation activities. These activities were broken down in the following ways. A third of his GT time was spent responding to telephone and mail requests for information and 10% of his GT time was spent giving seventeen demonstrations/presentations in Kentucky and seven other states. Finally, the remainder of his time (about 7%) was taken up by entertaining twenty different groups of U.S. and international visitors. This was unplanned, but easily explainable, since GT was a national pilot study that attracted much interest.

6. Other Administrative Considerations

By the time this report is distributed in Kentucky and in other states, the GT system will have in all likelihood moved into its second generation. Proposed new directions reflect some of what has been learned from this pilot test. At the present time, plans are for a micro computer network with one vendor developing both the state and county equipment. In addition to

supplying the computer network, the vendor would also sell the terminals that farmers would use to access the data base. Using only one vendor would alleviate some of the aforementioned interface problems and also would focus the major responsibility for the systems' operation on a single company. If one were starting a computer-based information delivery system in a different state, this strategy would be worth considering.

As mentioned previously, a single individual needs to be responsible for the system at the university level. Allocating a major portion of one administrator's time is necessary during the start-up period. After the system is running, this person would only need to spend from 10-20% of his/her time on its operation. Moreover, decision making in both the start-up period and during the operational phase would be facilitated if this person had some familiarity with hardware and software technology.

Administrators feel that GT has sensitized them to other uses for computers. At the county office, computers could be used to keep county records, to serve as word processors, and to store a library of interactive programs on discs. These record-keeping capabilities could include mailing lists, budgetary information, and client contacts by topic and meeting participation. Performing these tasks by computer could free agents from many routine functions, and concurrently could establish a way to pinpoint local farming needs and interests. Without doubt, the preparation of mailing labels and word processing capabilities could save the secretarial staff a great deal of time, which they could use in more constructive ways. Storing interactive programs at the local level is another use that would give the farmer an opportunity to duplicate those programs for their home computer or utilize the program at the county Extension office.

A general issue that needs to be considered is the fear that computers will replace people. Incorporating non-GT computers into county Extension offices would probably not change the number of staff, but

it might change the type of training and skills needed. This would necessitate retraining existing staff and hiring people with computer-based skills. In this way GT has influenced the perceptions of administrators in terms of future hiring in Extension. They feel that computers will eventually be included in every phase of the Extension program. Consequently whether it be as specialist, agent, or clerical staff, an individual's experience and familiarity with computers will be an important consideration when hiring new personnel in Extension.

7. Generalizations

The following is a summary of generalizations based on administrators' perceptions and experiences from this project.

a. Administrators have an expanded vision for use of computers in Extension because of their experience with GT. They now recognize that computers are capable of performing other functions beyond mere information delivery. Examples are (1) maintaining county records, (2) word processing, (3) use of analysis programs from a library of available programs and (4) delivering educational programs for adults and youth.

b. Administrators felt computer-based delivery systems would increase staffing needs for professionals and support staff (e.g., programmers).

c. Administrators felt that computers, in general, would require some retraining of existing staff.

d. Administrators felt that computer experience would be a necessary consideration whenever staff were hired or replaced.

8. Recommendations

a. A project director should be responsible for overseeing and coordinating a GT system, as well as being the liaison with vendors and information providers. To handle these roles easily, this person would need to be familiar with hardware and software computer technology.

b. Vendors and information providers should provide a counterpart to the university administrator.

c. The project director should devote a major portion of his/her time to the project during the preoperational and start-up period. After the system is operational, 10-20% would be sufficient.

d. Because computer delivery systems are new to most individuals, training procedures should have an initial session and a follow-up session for those who may still have problems operating the system.

B. State Specialists

Out of approximately 100 agricultural specialists at the University of Kentucky Extension Service, 67 made some contribution to the GT project. Most specialists were marginally involved in the project, e.g. some prepared less than ten GT frames over the course of the project. This marginality is further exemplified by the number of specialists from each department working on GT. From only three departments (Agronomy, Horticulture, and Home Economics), 39 specialists were somewhat active in GT, while in the remaining 10 departments, 28 specialists worked on the project.

Of these 67 specialists who made a contribution to GT, 13 GT departmental coordinators and 4 other specialists were interviewed by the UK evaluation team. Even though the fringe specialists were not interviewed directly, each GT coordinator discussed their contributions to the project. In some departments, the coordinators organized GT assignments on a rotating basis, while in others, some specialists ceased their activities because of problems that affected all specialists (to be discussed later in this section). In addition to the interviews with these 17 specialists, 4 staff members (from a total of 13) and 1 marketing research assistant were interviewed.

These interviews along with direct observation by the evaluation team are the basis for analyzing the specialist's role and contributions to the project.

This examination is divided into the following topics: organization of departmental entries, specialists' attitudes toward GT, information, interaction patterns, time requirements, generalizations, and recommendations.

1. Organization of Departmental Entries

Most coordinators divided their topics according to speciality area.* This meant that specialists were responsible for anywhere from one to ten frames in their area of expertise. As mentioned above, a few coordinators exposed a maximum number of specialists to the project. Market and weather coordinators had to organize their departments differently because of the timely nature of their information. The marketing coordinator automated as many frames as possible (80%) and also arranged for contributions from three specialists. Weather had 50% of their frames automated; Agricultural Weather Center staff manually entered the rest of the information received from the National Weather Service wire service.

The Agricultural Weather Center Director also worked with seven agricultural production specialists by combining weather and related speciality information. Not only was this information put on GT, but it was also sent to the NWS Environmental Study Service Center (ESSC) at Purdue University. ESSC, in turn, fed this agricultural-weather information to the Kentucky Weather Wire and to National Oceanic Atmospheric Administration (NOAA). The information was then disseminated over their communication networks. After seeing the exposure this information received, the specialists increased their participation in this effort.

Ten GT farmers from different parts of each county were selected to take weather readings and send them to the Weather Center by means

*The 4-H coordinator was the only specialist on the 4-H staff to enter information on GT.

of the GT system (e.g. soil and air temperature, relative humidity, wind speed). These measures were to be summarized for each county and then provided back to the farmers on the GT system. Problems related to this service persisted throughout the test.

Green Thumb departmental coordinators attended the GT coordinating and advisory meetings where, in addition to a wide range of discussions, they received usage feedback from the evaluation team. This information consisted of farmer usage of each of their departments' frames and reports on general trends and monthly usage patterns. Only six departmental coordinators related the proceedings of these meetings back to the other specialists working on the project. Reports of low frame usage caused three of these departments to delete some of their frames. Importantly, the departments that did provide this information to the other specialists, did so, mostly in the beginning of the project. (The reasons for this are examined in "Specialists' Attitudes Toward GT.")

Green Thumb departmental coordinators generally concluded that there was inadequate coordination at the administrative level of the project. This possibly contributed to the loose management within their own departments. These observations need to be examined in light of the fact that GT was an add-on project that supplied no additional staff to most departments and only limited added resources. As we shall see, these factors were sufficiently important that GT may not necessarily have been an accurate indication of specialists' activities in a future computer-based delivery system.

Departments varied a great deal in who, where, and how GT information was entered. In 6 out of 13 departments, specialists entered their own information. A secretary performed this function in the remainder of the

departments. Irregardless of who entered the information, 16 of the 17 specialists were frustrated with this activity. They felt it took more time than was warranted. Specialists who entered their own information either used their own departmental equipment, borrowed portable terminals to use in their offices or homes, used equipment from other departments, or went to the nearby Agricultural Data Center. Because of the overload on their secretarial staff, some specialists "borrowed" the use of secretaries from other departments. The secretarial staff who entered information were not as impatient with this arrangement as were specialists. Three reasons were mentioned: 1)it was a break from their other duties, 2) they genuinely enjoyed learning to work with computers, and 3) they spent less time than specialists trying to get a telephone line into the state computer because they were able to call during slack periods.

An interesting side effect of specialists and staff using portable terminals in their offices was that it tied up a telephone line. This prevented office mates from calling out, as well as blocking incoming calls. In addition, attempts to use the same telephone line sometimes disconnected the computer interface. A disconnection added to the frustrations of entering data, since any work during that session was lost.

Also related to data input procedures were different formating styles. During an early advisory meeting, one user said that because of the poor information display "only a mother could love it." This endearing criticism fit, especially in the first months of the test. Specialists were encouraged to work on improving their presentation. In the words of one UK official, they made "dramatic improvements" over the course of the project. Although they did improve, specialists were never trained in display techniques and, consequently, never did have a polished presentation. They used trial and error to discover what, to them, was the best way to pre-

sent their information. Also, since specialists worked alone, there was a lack of uniformity within or across disciplines. This was exemplified by differences in the number of spaces skipped between lines, centering of the material, and the amount of information put on each frame. There were also more serious display issues that were unstandardized, for example, whether to put ones' name at the end of the frame or include the projected date of the next update on the frame.

2. Specialists' Attitudes Toward GT

Almost without exception, specialists began the project with a favorable attitude toward GT. They were extremely enthusiastic and felt that computer-based delivery systems have tremendous potential. A few (20%) maintained a high level of enthusiasm throughout the project. They realized GT was a pilot study that would not work perfectly all the time. The majority of specialists (80%) were not as tolerant. Their attitude went from extremely positive to negative. Even with their declining attitude, however, they continue to feel that GT has tremendous unfulfilled potential.

Some of the reasons that specialists' attitudes turned negative have been alluded to already. These include problems entering information, being an add-on task in a busy schedule, inadequate training, and low usage. In addition, three factors unique to this test contributed to their attitudinal change. First, some specialists did not feel they could justify spending time on GT when only 200 farmers were in the test. Secondly, none of the 200 farmers in the test had any use for information from some specialists. For example, there were no commercial producers of vegetables or fruits; consequently, horticultural specialists did not have an audience for their information. Thirdly, unreliable hardware influenced the attitudes of specialists. Sometimes, they put information on the state computer that the county computer never received. Other times, the

system shut down completely. During these times, specialists felt that it was futile to try to keep their information current.

3. Information

Based on the usage information cited in another section (Chapter V. B. 2), weather and market were by far the most popular categories of information in this test. This type of information is perishable, since the content changes daily, hourly, or on a minute-to-minute basis. Perishable information was well suited for GT. However, most of Extension's information is nonperishable; that is, it does not become out-of-date for a substantial period of time (e.g. six months). One could argue that durable information like this was inappropriate for this type of computerized delivery system (e.g. number of acres farmed in a county). On the other hand, why not use a GT system rather than a bulletin or a newsletter? It may be cheaper, easier, and more readily available to the user.

Related to the perishable nature of information is the seasonality of much of it. GT was not very reactive to this need, even though there are different informational requirements that surround each phase of the farming cycle. One potential use of computer systems is to provide seasonally relevant information through an educational package i.e. a series of frames on a single topic. One specific example can better demonstrate this phenomena. Tobacco plants are more susceptible to blue mold early in the growing season when the weather is hot and humid. This can easily be communicated by presenting a series of frames on the topic that identify the disease, present steps to treat it, recommend additional steps to prevent its spread, and elaborate on the relationship between the weather and the disease. The alert page could inform farmers of an informational package like this.

An objective in the test, as specified by the cooperative agreement, was concerned with the type of information that would be disseminated. It was,

> "To test the feasibility of operating a computerized system for dissemination of weather, market, and other agricultural production and management information on a day-to-day basis." (Cooperative Agreement, 1978:2)

Therefore, it clearly specified weather, market, and other agricultural production and management information as the intended subject matter. In accordance, farm operators were chosen as the intended audience. And, farmers were queried as to what they desired on the database. However, Extension staff were excited over the potential use of a GT-type system for disseminating all types of Extension information. The type of information was expanded beyond the scope of the original agreement. Home Economics, 4-H/Youth, Community Development and Rural Sociology were included in GT. Through their inclusion, specialists entering such items expected their information to be accessed as much as agricultural advisories (excluding marketing and weather). However, the sample was selected on the basis of farm characteristics rather than household or community composition. Therefore, it is unfair to compare the usage of these topics with agricultural subjects. An additional point to be made here is that these specialists never knew exactly the composition of their audience. Therefore, they could not direct their information accordingly.

Green Thumb raised questions about the proper target group for specialists' information. In Extension, the primary audience for their information is county agents. Agents receiving specialist information review and disseminate it to interested farmers. Specialists not only distrubute information to agents, but also work directly with farmers through home visits and meetings. A GT-type information system communicates simul-

taneously with farmers and agents. This allows for a broader dissemination of specialists' information, but could be seen as bypassing the agent. Nevertheless, agents also contributed to a broader dissmenation of the information by revising some of it for use in other mediums e.g. newspaper articles.

A related issue concerns the responsibility/liability for GT information. This was a problem when there was no reference as to the source of the information on the frame. Likewise, farmers would probably lack confidence in information that was not documented. It became even more confusing the farther the information was from the source, e.g. when county agents further used the information. Though a few specialists began putting their names at the end of advisories, this issue of responsibility/liability is still unresolved. Conceivably, the University, specialists or person who reuses information are all, in some ways, responsible/liable. Guidelines on this will need to be developed by administration in the near future.

The quick turnover of information on computer-based systems causes other problems. Because GT does not provide a written copy, farmers could miss some frames or only vaguely remember their contents. This information might then be inaccessible when needed or used incorrectly. One recommendation for a future system is for the county office to store a weekly dump of the information on the system.

Specialists gathered the information they entered onto GT from many sources. These sources included newsletters, bulletins, journals, books, and their own research. Oftentimes, compiling information for GT led to other uses for this same information e.g. newsletter. This process was reversed when some information on the system was used prior through other mediums. However, this generally required that the message be substantially shortened. A few specialists commented that GT required them to pare

away unnecessary verbage and forced them to present the meaning of the message without the frills. Other information developed specifically for GT was never made accessible to non-GT farmers. Importantly, GT information complemented and supplemented other Extension channels, but did not replace any.

Specialists were frustrated by the inherent difficulty of entering graphs or illustrations on the system. This was because of limitations in both software and hardware components of GT. This affected the amount of time it took to create the image, chart, or graph and the imprecise nature of the final product. All specialists felt that in future systems illustration would be an extremely useful way to present information. This capability is necessary for any comptuer-based system, since part of the benefits of a medium that is visual is the ability to use facsimiles that can represent complex processes at a glance. Specialists ideas on how they could specifically use illustrations is listed under "Suggested Usages" at the end of this section.

Previously mentioned was the possibility of combining information from different disciplines. During this project, this was done by the UK Agricultural Weather Center and a few specialists. However, the need to merge information from a variety of sources was recognized by all the specialists. One suggested appointing a GT coordinator from each department who has a general enough background to be familiar with all aspects of their discipline. These individuals could serve as contacts within their department, as well as working with the editor and other departmental coordinators. Some focal points for merging information could be commodities, plant or animal diseases, or farming procedures.

Specialists felt GT could be used to familiarize county agents with their information, thereby preparing agents to work directly with farmers

in place of specialists. However, this did not occur with any regularity in this test. Some reasons were that specialists did not change their information regularly and, like everyone else, county agents did not use GT as much after the first few months. However, another educational use for GT was more successful. At the request of the Todd County 4-H agent, a careers program was developed for junior and senior high school youngsters. The Community Development (CD) coordinator prepared an instructional program called the "World of Work." This program was a six-week course that had ten different frames of information per week. The course was included in the curriculum of a civics class in the county public school. The CD specialist also developed supporting material to accompany the GT frames. The program was well received by students, teachers, parents, and high school administrators. This success is an indication that GT-type systems can be used as a complementary teaching tool, an audio-visual aid, or an educational aid for groups of agents and farmers.

4. Interaction Patterns

Interaction between specialists and county agents, and specialists and farmers was not affected to any significant degree by GT. Nevertheless, specialists were asked to project on the anticipated effect a future statewide, computer-based delivery system would likely have on interaction patterns. There was no overall agreement. Some felt that interaction would increase between agents and farmers, while they, themselves, would interact less with farmers and more with county agents. Others felt that GT would not affect the quantity of interaction with agents and farmers, but would increase the shared basis of information before personal contact was made. This would influence the quality of the contact. Still others felt that a GT-type system would not affect interaction in any way.

An administrative and specialist goal of GT in a future system is to reduce the travel for specialists. To accomplish this, guidelines for

seeking information would need to be established. Farmers would be encouraged to first, consult the GT data base; second, follow up any reference from that information; third, consult with the county agent; and, if more information is needed, then use the agent to contact the specialist. If the objective is to reduce the use of specialists for individualized service, this would be an ideal process. However positive this looks on paper, in practical terms, it is extremely fragile. Especially when a farmer has a pressing problem, consults GT, and sees a specialist's name on a frame that addresses his particular problem. This might encourage him to contact the specialist directly and, therefore, result in increased use of specialists.

Another related goal mentioned by both specialists and administrators is using GT to reduce the number of group meetings that involve specialists. One way to accomplish this is by using GT to substitute for some meetings. A second possibility is to inform agents about a topic through GT; in turn, agents could communicate this information to farmers through county level meetings. However, aside from communicating new information at group meetings, they also serve social functions of renewing relationships, developing additional contacts, and introducing recently hired specialists and new farmers to others in the farming community. Therefore, an inherent problem with substituting GT for group meetings and establishing the above guidelines for seeking information would be a reduction in interpersonal contact. Usually regular contacts are needed to build up confidence between specialists and farmers/agents. Related to this, by its nature, a computer delivery system is an impersonal medium. If used in the above ways, social relations in Extension would likely take on a more impersonal quality. A third use not directly related to reducing the number of meetings is also possible. Before the meetings, specialists could use GT to communicate information about the topics on the program. Then, at the

meetings, specialists could use GT as a teaching aid. This would probably lead to a more efficient use of time during the meeting.

5. Time Requirements*

About 50% of the specialists felt that if GT were a permanent part of Extension, more staff would need to be added to their departments. This dropped to 15%, if an editor and graphic translator would enter their information. These duties are very important when considering how specialists spent their time on GT. This can be divided into three periods: the pre-start up (February, 1980 to March, 1980), the start up (first four months of operation) and the closing (last nine months of the test). During the pre-start up period, some specialists spent a substantial portion of their time (from 20 to 50%) on GT. This was distributed between meetings, training sessions, and composing the initial GT frames. During the second period, they spent approximately 15% of their time on GT and were updating their frames fairly actively. In the closing period, the problems besieging the system influenced the time they spent on the project. The majority of specialists ceased their GT activities, while the more devoted averaged only about 5%. Through all the periods, those specialists who entered their own data spent about half of the time they devoted to GT on the process of entering the information. The remainder was spent on researching and compiling the information. Based on their experiences on this project, specialists generalized that by spending 2-10% of their time on a future system, they could fulfill their responsibilities. This is predicated on the assumption that the system would be state-wide and there would be a central system of data entry.

*Data for this section was based on information gathered from specialists' interview. These estimates were then substantiated by comparing them with the Kentucky Extension Management Information System (KEMIS).

6. Generalizations

a. Attitudes of specialists were extremely positive in the beginning of the project, but gradually became negative due to:

(1) Some specialists information did not match the informational needs of users e.g., there were no commercial vegetable or fruit producers in the test group.

(2) Data entry problems.

(3) Difficulties justifying spending time on GT for only 200 farmers.

(4) GT being an add-on task in an already busy schedule.

(5) Unreliable hardware and software.

(6) Inadequate training.

(7) Low usage of their frames.

b. The amount of time specialists spent on GT declined with their attitude. During the month preceding the start-up of the system, some specialists spent from 20% to 50% of their time on GT. In the next 4 months, they spent about 15% of their time on the project. Though the last nine months, some spent less than 5% on the project while most had ceased working on GT.

c. Information, in some cases, was inappropriate for the GT system. Perishable information such as market and weather was more frequently accessed than nonperishable information.

d. There was a lack of interdisciplinary coordination in the project. Specialists felt this would be beneficial in an expanded system.

e. Graphs and illustrations were difficult to enter onto the system due to the inadequacy of the hardware and software.

f. Specialists developed some information specifically for GT, while some information, developed for other purposes, was repackaged and put on GT; still other GT information was repackaged and used through other

mediums. Generally, GT information complemented and supplemented other Extension sources and did not replace them.

h. Interaction patterns between specialists and agents, and specialists and farmers were not affected by this test.

i. Some specialists felt that in future systems interaction patterns would increase between the agents and the farmers, while they, themselves, would interact less with farmers and more with agents.

j. Other specialists felt that GT would not affect the quantity of interaction with agents and farmers, but would increase the shared basis of information prior to contact, which would influence the quality of the contact.

k. Others felt a GT-type system would have no effect on interaction.

7. Recommendations

A variety of issues and concerns about the role of Extension specialists in future computer systems were raised in this section. For the reader's convenience, these are summarized below. This listing is divided into the following general categories: organization, information, and travel. For developing a future computer-based, informational delivery system, we recommend that:

a. Organization

(1) A general orientation and information session be conducted with all Extension specialists. The main purpose would be to demonstrate how such an information system can be of use to them in their program.

(2) A central system of data entry be established.

(3) An editor be primarily responsible for coordinating the information on the system. Specifically, the editor would

(a) Work full-time on this system,

(b) Have a varied background in the areas of agriculture, journalism, and communications, as well as some familiarity with computer systems,

(c) Monitor system information so that duplicate or contradictory messages would not be put on the system, and

(d) Assist the specialist in the improvement of format and display.

(4) An "alert page" for disseminating emergency-type information be established. This information would originate from specialists and be presented through short, concise text messages on the first frame of each session.

(5) Use of the alert page be available to all specialists. They would send their message to the central data entry point.

(6) A coordinator be appointed from each department.

(7) The coordinator and the departmental chairman divide specialists' input into areas of expertise within the department.

(8) Regular staff meetings be established. Attendance would include the project director, departmental coordinators, and the editorial staff. The purpose would be to discuss new ideas and coordinate interdisciplinary information. Operational issues would be decided upon by this group.

(9) The editor provide usage information to departmental coordinators. In turn, coordinators would redistribute this information to other departmental specialists.

(10) Users of the system be invited to attend these staff meetings periodically.

(11) Departmental coordinators spend about one-quarter of their overall time in this role, while other specialists allocate from 1-10%.

(12) The editor establish additional outlets for the system's information (e.g. news-releases, radio spots, etc.). In addition, he/she could expand the distribution beyond the state by establishing outlets with federal and multistate communication networks, e.g. NOAA.

b. Information

Recommendations concerning the information on a GT system are that:

(1) As many frames as possible be automatically updated.

(2) Menu listings should accurately describe the information contained in the frame and not be too general.

(3) Subscribers be provided with updated written copies of the menu listing on a regular basis (e.g., once per week).

(4) Each frame include the name of the person who developed the information.

(5) The projected date for the next update be included on the frame.

(6) Follow-up references be included on frame, so users can locate additional material on the topic (e.g., referring the user to other frames, newsletters, bulletins, and so forth).

(7) A complete printed copy of all information on the system be made weekly. This would provide for documentation of system contents for purposes of comparison, for use as a printed message, and for purposes of liability.

(8) Administrators develop guidelines on the issues of responsibility and liability for information disseminated through a computer-based system.

(9) Potential users be surveyed about their information needs before the system is operational.

(10) Users be surveyed for background information. Specialists could then better target their information.

(11) Highly perishable information be given the highest priority (e.g., weather, market, disease outbreakes, etc.) and timely nonperishable information be given second priority (e.g., planting information in spring).

(12) The alert page inform users about related information on the system (i.e., a series of frames on a single topic).

(13) Information used in other ways be modified for GT e.g., newsletters.

(14) Information presented on this system be reused by specialists in other mediums e.g., radio broadcasts and newspaper articles.

(15) Educational programs be developed for specific audiences e.g., the career search program on GT.

(16) More information be presented in a graphics format.

c. Travel

Recommendations for reducing specialist travel are that:

(1) Information be developed by specialists to substitute for some group meetings.

(2) Information be directed at county agents so they, in turn, can communicate this information to other farmers at county level meetings or on an individual basis.

(3) Information be used prior to group meetings to sensitize farmers and agents to topics on the program. Additional information could then be used during the meetings as teaching aids.

(4) The following stepwise procedure for seeking information be established:

(a) consult database

(b) follow up on references from that information

(c) consult with the county agent

(d) request that county agent contact a specialist

d. Suggested Future Uses

In addition to the recommendations that have been proposed, specialists had ideas on what particular information would be useful for this type of delivery system. They also speculated how to use visual presentations in relation to their speciality. We think it is worthwhile to present their ideas here.

Speciality	Future Uses
Agronomy	-Graph soil moisture patterns (visual display)
	-Graph soil temperature patterns (visual display)
	-Combine weather forecasts with the soil temperature and moisture thresholds to indicate when planting conditions are favorable. (visual display)
Animal Science	-Design and layout specifications for milking and cow operations; hog operations (visual display)
	-Swine break-even costs for different feed mixtures
Community Development	-Public issues
	-Job service; equal opportunity problems
	-Summer jobs
	-Civil service test information
Forestry	-Identify diseased or infested trees (visual display)
	-Show how to weed wooded areas for a) wildlife preserves b) selling wood (visual display)
	-Display proper prunning techniques (visual display)
	-Provide monthly prices for varieties of wood
	-Communicate fire warnings

Speciality	Future Uses
	-Since the state is divided into three forest regions, target appropriate information to each region.
	-Forest rangers could send information back to the editor for redistributing on the system, e.g. dryness/moisture indicators of the forest.
	-Identify federal cost-sharing programs for planting and for fencing-off areas.
	-Information on location of forestry offices
	-List laws on burning in various areas
	-Present information on recouping land after surface mining
Entomology	-Identify problem insects and recommend solutions (visual display)
	-Show daily movement of infestation by shading areas on a state map (visual display)
	-Automate daily updates for the Integrated Pest Management System.*
4-H	-Download interactive educational programs for use at youth camps or home.
Home Economics	-Designs for clothing (visual display)
	-Canning recommendations
	-Information on food diseases
	-Seasonal information on gardens; unusual ways to use garden surpluses.

*This was attempted in GT, but too much time was spent on editing information that was received from the counties. It would be necessary to develop a computer program to edit this information.

Speciality	Future Uses
	-Legislation on topical concerns
	-In case of flooding - how to salvage food, sanitize clothing, and similar concerns.
Horticulture	-Spraying procedures on fruit trees or vegetable plants (visual display)
	-Proper planting and banding procedures in terms of depth, spacing, etc. (visual display)
	-Pruning of fruit trees and vegetable plants (visual display)
	-Floral designs (visual display)
	-Target information to agents
	-Automate market prices on fruits and vegetables during certain times of the year. Prices on apples and peaches, and tomatoes, peppers, and cabbages are especially important.
Marketing	-Graphs and charts could be used to show patterns and trends (visual display)
	-Tabular display would be helpful for a variety of marketing information.
	-Reserve levels of commodities
	-Movements of grain and commodities
	-Production levels
	-Import and export figures
	-Transportation costs e.g., barge rates
	-Storage figures

Plant Pathology	-Illustrations could be used to show progressive symptomology of particular diseases (visual display)
	-Rainfall, leaf wetness, soil moisture, and temperature could be graphed in combination with the potential spread of particular diseases. (visual display)
	-Local and state maps could be used to show the spread of diseases. Note: not all farmers report disease problems all the time. (visual display)
	-Send test results of soil samples to farmers.
Weather	-More precise maps and symbols could be used to refine the overall weather presentation (visual display).

C. County Extension

Todd and Shelby Counties are generally recognized as having two of the better Extension programs in the state. Todd County is basically a rural farming community with the nearest large urban center, Nashville, Tennessee, being sixty miles to the south. The Extension office is located in the city of Elkton, the county seat. The Extension program in Todd County has played a part in a variety of farming innovations such as doublecropping, no-till farming, Farm Business Analysis, and Integrated Pest Management (hereafter referred to as IPM). Some claim that the IPM program was conceived and first instituted in Todd County.

Unlike many other Extension offices in Kentucky, the Todd County office is housed in a modern building with central heat and air conditioning, up-to-date equipment, and adequate office space. This environment facilitated the incorporation of GT into the County's daily operation. The following members work out of the Todd County office: an Agriculture agent, a Home Economics agent, a 4-H agent, a county IPM coordinator, and a secretary.

The Shelby County Extension office is also recognized as having a progressive Extension program. By contrast, however, Shelby County is located adjacent to the Louisville metropolitan area. It is close enough that many Shelby County residents commute to Louisville for work. In addition, the county is only about ten miles from Frankfort, the state capital, and about forty miles from the city of Lexington, where the University of Kentucky, the land-grant university in the state, is located. The Extension office is in the county seat of Shelbyville on the basement floor of city hall. This building is an old structure that was undergoing renovation during the operation of GT. These changes, along with the fact that the GT computer was located in the Agricultural agent's office, turned out to have an

adverse effect on the working environment.

In addition to the office environment, type of county served, and types of farming (see Chapter V, E), there were other significant differences between the two counties. These were the organization of office duties, the involvement of other county staff members in GT, the amount of the Agricultural agent's time devoted to GT, and the functions performed. At the same time, there were similarities between the county agents: their reuse of GT information, the types of information they provided, and their projections on both the role of the county agent and the future of GT-type information delivery systems in Extension.

1. Office Organization

In relation to GT activities, the Extension offices in the two counties were organized quite differently. In one county the Agriculture agent involved the total office staff in the operation of GT. In this county the IPM coordinator and the 4-H and home economics agents either entered information directly or were assisted by the secretary. Each staff member was also able to perform daily maintenance tasks on the equipment; such as, restarting the computer if it shut down. The county microcomputer and a cathode ray terminal (CRT) were both located in an adjacent storage room. However, the GT box and television hookup were placed in a common work area, easily accessible to all the staff.

Beyond simply entering information into the system, the IPM coordinator worked with entomology specialists at UK to send local IPM data to the university. It was then converted into GT frames and relayed back to the county. However, verification of the data by the entomology staff was too time consuming, leading to a discontinuation of this service. Specialists at the Entomology Department plan to develop a computer program to perform this

verification function, provided the number of users becomes large enough to warrant this investment of time.

The 4-H agent, as previously noted in this chapter (see B.), was also involved in other activities aside from merely entering information. In the beginning of the project, he requested that a UK Community Development specialist formulate a career development program. This specialist then developed sixty frames of information on the topic and divided them into a six-week course. Because of the 4-H agent's active involvement, the school system and 4-H camps utilized this course.

In the second county, the agricultural agent carried most all of the load of the GT operation. He took full responsibility for the daily operation of the system. This included entering his own frames, daily maintenance of the computer, and hosting visitors interested in GT. Secondly, the 4-H and Home Economics agents entered a few frames, but they did not use the system very often. The 4-H agent did express an interest in the career program, but never utilized it. In this county the secretary did not work with GT until near the end of the project. At this time, the county agent taught her how to restart the computer. Overall, in this county there was a limited involvement of Extension other than the Agricultural agent.

Although unique factors need to be considered in relation to the two county Extension offices, based on organizational factors, it is desirable that future systems follow the model of extensive involvement of as many staff as possible. This type of "team" approach fosters cooperation, which leads to better utilization of a GT-type system at the county level.

a. Unique Influences in Shelby County

Two exceptional factors affected the Shelby County situation: equipment

problems* and the need to entertain visitors. The equipment in Shelby County was much less reliable than the Todd County hardware. This was evidenced by two major malfunctions that occurred in Shelby County, compared to one minor mishap in Todd County. These problems were solved only after lengthy periods of malfunctioning equipment.

Unrelated to specific equipment breakdowns, the Shelby County agent estimated that the county computer shut itself off, and remained off, 15-20% of the time (compared to a 2% estimate in Todd County). Additionally, the update program in both counties failed approximately 40% of the time. The county agent finally wrote a letter of complaint late in 1980 stating that repeated failures by the county computer were undermining the experiment.

In addition to the effect these breakdowns had on the system, they also occupied the agent's time. Halfway through the test, the update program ran so poorly that he began restarting this program himself (rather than at the state level). This added to his responsibilities and increased the time he spent on the project.

Placing the computer in his office became another influence on the agent. If the update program failed to run, the county computer was programmed to buzz every fifteen minutes. Because of the extensive problem with this program, the buzzer went off fairly consistently and buzzed until the agent turned it off. As one can imagine, this became quite a nuisance.

Entertaining visitors was another unique influence on the Shelby County agent. Most groups visited this county site rather than Todd County due to its convenient location. By the end of the project, thirty groups had visited Shelby County (compared to less than five groups in Todd County). Not only

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* See Chapter IV for a detailed examination of these equipment problems.

did each group take up a considerable amount of the agent's time, but some groups came unannounced, forcing the agent to alter his schedule.

In combination, equipment problems, placement of the computer, and entertaining visitors were distractions which affected only the Shelby County agent. In this context, recommendations can be made about the placement and maintenance of the computer. If we expect agents to maintain a computer system in addition to his other functions, then it must be more reliable. Additionally, locating the computer in an out-of-the-way place and teaching other staff to maintain its operation seem to be reasonable suggestions, as this would minimize the types of distractions reported above.

2. Information

Extension methods for contacting clientele can be divided into three categories: 1) individual, 2) group, and 3) mass media. Individual methods of contacts are varied in that they include office calls, telephone contact, personal letters, circular letters, and home visits. Group contacts take the form of workshops, short courses, seminars, conferences, leader training, and so on. The mass media, as its name implies, is designed for a broader dissemination of information. Although GT is a mass media method of contact, it also has ramifications for individual and group methods.

The two county agents used GT to enter informational items that were locally relevant. Parts of GT information overlapped with each of the other dissemination methods, e.g. radio, workshops, and telephone contacts. However, on the whole, county agents felt that GT information complemented these other methods and could, in no way, substitute or replace them. This is an important observation for the future of computer delivery systems in the Extension service.

The types of information agents entered on GT were either of a general nature, that is, suited to common farming needs, home care, and gardening; or, more specifically directed at the needs of the particular county. Each county Extension staff had twenty frames available to them. The following represents an approximate distribution of these frames for both counties: the Agricultural agents used fifteen frames, the 4-H agents, three, the Home Economics agents compiled two, and each IPM coordinator reported their data on one frame. The Agricultural agents put the following types of information on the system: grain and livestock notes, disease outbreaks, technical information such as instructions in the use of pesticides or fertilizers, calendar items, and farm management advice. The 4-H agent entered material on camp notices and project tips. The Home Economics agents supplied information on home energy needs, gardening, and canning. In spite of geographical and farming differences, there were many cases when frames from both counties contained similar information. This suggests that there is a danger of duplication between counties. Multicounty GT centers at strategic places across the state would help to avoid duplicate equipment, information, and staff. However, even with multicounty centers, county agents need to have the opportunity to enter county specific information. Multicounty centers would be only one way of organizing a GT-type system. This may not be feasible for states whose extension service varies from the Kentucky Extension Service or a state that has different farming needs.

In the development of GT information, both county agents stated that the GT frames they developed provided information to GT farmers that other farmers did not receive. Similarly, these agents received information from UK specialists that other county agents could not access. In some cases, they repackaged specialist's GT information and used it for other purposes,

such as radio spots, newspaper articles, and circular letters. They stated that GT made these tasks easier for them.

One way of expanding the content and utilization of GT information is through specifically directing information to county agents. Specialists could use GT to inform agents of current developments in different speciality areas. This notion was widely endorsed by specialists and accepted by the agents as being potentially useful. Also, a GT system could be available for other farmer services. These could include advertising services and merchandise such as custom harvesting, hay for sale, and land for rent.

Throughout the test, farmers and county Extension personnel requested that local grain and livestock prices be provided on GT. However, this service was never provided due to a number of unresolved issues. Who would be responsible for the accuracy of this information? Who would collect and enter the information? How much detail would have to be provided? How many different grades and weight classes should be provided? Should other factors such as deductions for weight and moisture levels be included? How often would prices be entered? In addition to these questions, the consideration of staffing requirements quickly expands the scope of this issue. The following illustrates its complexity. There are a few grain elevators and livestock markets per county and 120 counties in Kentucky. Loosely translated, this equals over 500 outlets, each with a different set of local prices. If the university maintains full control of this system and these prices are processed by the local extension office, then the county agents would be put in an awkward position. First, he would be somewhat responsible for their content and, second, he would need to devote a considerable amount of his time to complete this task, which would necessarily compromise his other duties. For future systems, these concerns would need to be

addressed by the GT staff. Although these problems are formidable it is evident that providing local prices would increase the utility of the system.

3. Roles in Extension

Overall, no drastic role changes occurred for county agents during the test, nor are any expected in future GT-type systems. No computer delivery system can substitute for personal contacts such as farm visits and individualized problem solving. The two county agents who worked on GT felt that this needed to be stated clearly. The county agents had, what we consider, a healthy attitude toward this method of delivering information, that is, they felt it was a medium to reach farmers with quick-breaking or locally referenced information. Because of this emphasis, it complemented existing methods of information delivery, rather than substituted for them.

Although a complete role transformation did not occur for county agents, some modifications were evident. Again, the two county experiences were very different. The first dissimilarity was the amount of time each spent on the project. In one county the Agricultural agent spent 20-25% of his overall time on GT. Of this amount, about half was spent entertaining visitors, 30% developing information, 10% entering information, and 10% maintaining equipment. In this county, entertaining and maintenance activities represented a major portion of this agent's time on the project; whereas, the agent in the other county did not even mention these as part of his activities. He estimated that he spent 10-15% of his overall time on the project. Almost all of the time he devoted to GT was spent developing and researching information for the system. Due to the relatively large number of equipment malfunctions

and visitors to the one county, a commitment of 10-15% would be more realistic of the expectations for future systems.

A second factor considered here is the affect the GT experience had on other Extension activities. One agent stated that he sent out fewer circular letters and made fewer farm visits during the test. Whereas, the other agent reported that GT activities did not affect his office duties or farm visits to any great extent. An outcome mentioned by both agents was that the availability of the GT database made it easier to compile other communication medias such as circular letters. In relation to future GT-type systems, the two agents also agreed that if more farmers subscribed to this type of service, then, in all liklihood, it would stimulate more, rather than fewer, farmer contacts.

A third factor, representing a difference between the counties, was the involvement of the other county Extension staff (in addition to the two Agricultural agents). As previously noted, in one county the staff were widely involved with the project. This was a significant factor that led to their positive attitude toward GT in the beginning of the project. However, their enthusiasm declined gradually as problems developed with the updates. In contrast, because the Extension staff in the other county were minimally involved from the start, their attitude can be best described as apathetic throughout. While attitudes between the two staffs varied, the two Agricultural agents had similar perceptions toward the project. Both realized that GT was a pilot study that, in spite of problems, was still worthwhile because of its unrealized potential. Although they admitted being a bit discouraged toward the end of the project, their attitudes were still positive.

Experiences with GT prompted the county staff to consider other uses for computers in their Extension work. These uses fall under the general category of general office functions. Some functions a microcomputer could handle include generating mailing lists and monthly reports, maintaining EMIS data, listing publications by commodity or disease, and keeping files on budget items, inventories, and IPM information. Ironically, both agents had the means to use the UK computer facilities for these functions, but they were untrained and, therefore, unaware of how to tie together technical aspects of computer operations with these potential uses. Even with training, however, they would have had to spend a considerable amount of time designing software programs. Obviously, this time could not have been justified, given the short duration of the test.

4. Generalizations

   a. In relation to GT activities, the Extension offices in the two counties were organized differently. In one county, the Agricultural agent involved the total office staff, while the other Agricultural agent carried most of the load for the GT operation.

   b. The location of computer equipment had an effect on the working environment of the Agricultural agent. When lack of space required that it be set up in the agent's office, it was more distracting than when it was placed in an out-of-the-way spot.

   c. GT information complemented other information delivery methods and did not substitute or replace them.

   d. Agents entered information on GT that was oriented to both general farming needs, as well as the specific needs of the farmers in that particular county.

e. Both agents entered some information on GT that non-GT farmers did not receive through other sources.

f. Both county agents repackaged some GT information and used it for dissemination in other mediums (i.e., radio or newspaper articles). Related to this, both agents agreed that GT made it easier to compile information for these other uses.

g. No major role changes occurred for the county agents during the test.

h. This computer delivery system did not substitute for personal contacts such as farm visits and individualized problem solving.

i. One Agricultural Agent spent 20-25% of his overall time on GT; 10% of which was spent maintaining the equipment, 50% entertaining visitors, and 40% developing and entering information. This agent entered all his own information and assumed total responsibility for the system's daily operation.

j. The other Agricultural agent spent 10-15% of his overall time on GT. He received almost no visitors and the equipment had few maintenance problems. At least during part of the time, information was entered by the secretary. The office staff were all trained in the daily operation of the system.

k. Both county agents felt that GT did not affect their interaction with farmers but thought that a future statewide GT system might increase the number of farmer contacts. This is contrary to specialists' thinking, who believed that GT information could substitute for some county agent contacts.

l. Ironically, both agents had the means to use the University of Kentucky computer facilities from their own offices, but they were untrained and, therefore, unaware of the potential uses of this equipment.

5. Recommendations

Recommendations for use of a GT-type system at the county level are as follows:

a. In order to avoid having to duplicate equipment, information, and personnel in every county, a GT-type system could be located in multicounty GT centers at strategic places across a state. This strategy would vary according to the needs of each state.

b. Dissemination of general information as well as county-specific information are both important for farmers. Thus, future GT-type systems need to be designed to include both types of information.

c. Care should be taken to locate computer equipment so it does not disrupt normal office functioning.

d. A committment of 10-15% of an Agricultural agent's time would be required for this type of computer delivery system.

e. Training of all county staff in the use of a GT-type system would be a necessity.

f. Precautions should be taken so that hosting visitors does not become a burden to county staff. As more systems are developed, this will become less of a problem.

g. Expanding market information to include local prices of grains, livestock, fruits, and vegetables would increase the utility of the system.

h. Specialists can use a GT-type system to inform county agents of current developments in different speciality areas.

i. Consideration should be given to making the GT system available for other farmer services. This could include the advertising of such services and merchandise as custom harvesting, hay for sale, and land for rent.

j. In addition to GT, microcomputers could support county Extension functions such as maintaining county records, serving as word processors, and storing analysis programs. Specifically, record-keeping capabilities could include the maintenance of mailing lists, budgetary information, and client contacts.

VII

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Specific generalizations and recommendations are included at the end of the chapters and sections of this report. In this final chapter, they will be related to one another, with projections on future computer-based delivery systems, and to the overall organization of Extension. Also, recommendations concerning additional staffing needs for future systems, as well as an accounting of the time university and county staff spent on the project, will be presented in a summary fashion. Finally, larger policy issues are examined in terms of organizational concerns, budgetary impacts, informational considerations, and the issue of equity.

A. Technical Performance

General indicators of the performance of GT show that the test was reasonably successful and the overall design of the system was workable. Problems did occur, however, because of the following: the state computer performed functions unrelated to GT, the incompatibility of different types of computer units in the GT network, the general sensitivity of the computer to environmental factors (e.g. humidity, heat), and the fact that the technical staff at the University of Kentucky Agricultural Data Center did not have the time, equipment, or expertise to manage the system properly.

Though these problems were important to the functioning, and malfunctioning, of GT, they can be solved by some relatively simple adjustments. First, and probably most important, the central state computer should be dedicated solely to GT. This would alleviate the overload problems and most of the update failures which occurred in this test.

Secondly, most software linkage problems would be minimized if a single vendor provided both hardware and software components of the system. This

would lead to compatable software between units, while isolating the responsibility to this one vendor. Thus, this company would be accountable for connecting GT computers within the state system, as well as working jointly with national information sources (e.g., AMS) to establish reliable transmissions. In addition, more technical staff at the university level should be hired with expertise to handle unexpected breakdowns and normal maintenance functions.

Thirdly, environmental factors such as extremes in temperature and humidity, power fluctuations, and interference due to lightning all need attention in the system design. Again, when these potential problems are considered beforehand, the modifications are fairly simple and straightforward. Locating equipment where there is adequate temperature and humidity control, designing equipment to handle normal power fluctuations and surges due to lightning are all simple precautions which would contribute to a more reliable system.

Also under the context of environmental considerations is the transmitting medium that connects computers to one another. GT used telephone lines and had very few problems during the test. However, this does not necessarily mean this is the best type of possible transmission. Planners need to consider the costs of a telephone-based system, the increased traffic on the phone system, the (un)reliability of the telephone system, the degree of telephone penetration into the farming areas of their state, and the number of party lines in these areas (in the GT test it was stipulated that individuals on party lines could not be included). Consequently, planners would want to consider other transmission modes, such as cable or microwave. At the national level, CES administrators should investigate the possibility of utilizing satellite transmissions in order to establish a national informational network. In the long run, this might prove to be the most cost effective alternative.

B. Computer Design Problems

There were limitations in the computer system that represent concerns for the development of future GT-type systems. Farmers found it objectionable to

have to wait until the requested information was down-loaded into the Green Thumb Box memory (anywhere from 45 seconds to 3 and a half minutes) before it could be viewed. By modifying the computer software it is possible to allow users to view their information as it is being loaded into the memory of their home terminal.

Another needed improvement is related to graphic capabilities. Illustrations and visual representations were virtually nonexistant in this test because of equipment limitations. Systems possessing improved graphic capabilities should be utilized in future GT-type systems.

Other problems in this test affected the reliability of the system. Due to breakdowns, software problems, maintenance schedules, and the like, the data-base was up to date only about half of the time. The rest of the time information was on the system, but it was out-of-date anywhere from a few minutes to a day or more. In spite of this problem, there were no formal provisions made to verify whether information was current at the county level. About halfway through the test, the Weather Center began checking the county computers to verify information. However, they only verified weather information, since there was no county processor at the state level, they had to make long distance calls to the counties; verification checks were not as systematic as they could have been; and no verification was carried out when their office was closed (7 p.m. to 5 a.m.).

Related to this, once the update program ceased functioning, it had to be restarted manually instead of automatically. Both the verification function and an automatic restarting feature should be provided for in future GT-type systems. Finally, in addition to information storage and retrieval, computers possess capabilities for performing such functions as compiling and analyzing data. Including these functions as a part of a GT-type system would be ideal, however, at this time, there are too many technical problems for it to be feasible. Therefore, combining an informational delivery system with data

analysis is ill advised. Rather, until these technical problems can be corrected, data analysis programs could be made available to farmers through a library system. This would allow farmers who possess microcomputers to replicate these programs for their home use.

C. Aggregate Usage

Usage of the system declined substantially over the life of the test, especially after the first two months. It went from 5,000 calls per month in the beginning of the test to just over 1,000 calls by the last month. Some of this decline is expected with most pilot projects which experience an inordinate amount of interest in the start up period. By the last month, however, only one third of the sample were still using GT. Although this is a considerable reduction, factors such as slow updates and technical malfunctions contributed to this reduced use. From the standpoint of users, future systems must be made more reliable.

Over the 13-month test period, 35% of the users called GT on an average of two or more times per week; in Todd County it was 44%, while in Shelby County 25% used GT that often. Usage differences between the counties can be attributed to a combination of factors: The Shelby County computer had more technical problems than did Todd County; farmers from Shelby County earned a greater percentage of their income off-the-farm than Todd County farmers; livestock farmers, having less of a need for GT-type information, were mostly located in Shelby County (90%); and only 22% of the farmers with acreages of 1,000 or more were located in Shelby County (farmers working this many acres were high users). Consequently, computer problems mixed with farm characteristics and off-farm employment contributed to lower use by Shelby County farmers.

GT use, as it related to farm characteristics, did not yield significant results. Only the type of farm and size of farm showed a discernable pattern.

Crop farmers were the highest GT users, followed by mixed farmers and livestock farmers. And, only the largest farms (1,000 or more acres) used GT significantly more than farms of other sizes. Value of sales and farm organization failed to demonstrate significant differences in usage.

Likewise, differences in background characteristics of farm operators did little to explain GT use. The only strong relationship was the percentage of income coming from off-farm sources and GT use. It showed that those committed to farming, that is, full-time or almost full-time farmers, were more likely to access GT information. Aside from this variable, the others showed either a weak directional relationship or none at all. This is contrary to expectations of previous findings on the adoption of innovations. For example, farmers having the most education were the lowest users, farmers reporting the smallest family income were the highest users, and usage varied little by the age of the farmer. Also unanticipated was the finding that farmers who farmed from 11-30 years, not newer farmers, were the highest GT users.

As specified earlier, there are limitations of the data that restrict its generalizability, nevertheless, the results of this study suggest that those who accept and use computer technology of this type may not follow the traditional adoption model. A GT-type information system may be accepted more readily than previous innovations related to farm equipment and practices because users are already familiar with the existing technology of telephones and television, the system was relatively easy to operate and the information was easy to understand, it was free during the test and is a potential low-cost item in future systems, and there is a general facination with computers and the speed with which they operate.

The time of information request is important because of its bearing on future GT-type systems. Farmers used the system infrequently from midnight to 6 AM and less on the weekends than during the week. Therefore, there seems to be little need to operate a system 24 hours a day, 7 days a week.

Consequently, shutting down the system during low-use periods would decrease personnel costs and reduce malfunctions.

D. Usage by Information Type

Directly related to the above discussion is the specific type of information requested by farmers on various types and sizes of farms. In general, the results showed that some aspect of the GT database was useful to farmers on all sizes and types of farms. More specifically, large scale, crop farmers accessed market information the most, especially futures prices and information on market interpretation. Weather and Extension information were accessed at about the same frequency by all farm sizes. Farmers operating mixed farms requested weather and Extension information more than farmers on speciality farms, probably due to their need for a wide variety of information for both the crop and livestock portions of their farm operations. Finally, while farmers on small and medium sized farms accessed futures prices more than the other marketing frames, they also showed a relatively high interest in regional cash prices, as well as information provided by Agricultural Marketing Service (AMS). Out of these results, it is readily apparent that providing grain futures prices on a GT-type system would especially serve largescale, crop farmers; while, providing regional and local cash prices on grain and livestock markets would be of more benefit to small and medium sized and mixed farm operators.

It needs to be pointed out that not all farmers accessed GT information. Because livestock farmers are not as dependent on market and weather fluctuations, they were low GT users. In fact, they were the lowest users of every type of GT information. Based on this pattern, CES administrators in geographic areas where livestock production predominates, should question whether a GT-type system is warranted.

The most requested categories of information were market (55.5%) and weather (30.6%). In fact, together they represented 86% of the total requests.

In contrast, requests for Extension specialists' advisories amounted to less than 10% of the total. The most requested marketing items were grain futures, with the soybean futures prices being by far the top requested frame in both counties. Under the weather category, the county forecast, followed by the 3-5 day, state, and national forecasts, were the most popular. County Extension information was the third most accessed category.

There were several sources supplying information to GT. American Quotation Service (later Commodity News Service) provided futures market prices, market interpretations, and regional livestock and grain prices. AMS also provided some regional prices. The National Weather Service sent weather information to the UK Agricultural Weather Center where it was reformulated and disseminated over GT. Specialists and county agents compiled the rest of the information. Although the most requested frames were provided by American Quotation Service, this is somewhat misleading. With one exception of futures prices, most of this information is provided by AMS, a public agency. AMS passes it along to private firms like AQS, who add some market interpretation and relay this information to their subscribers for a fee. AMS officials have stated that they are willing to supply any of approximately 800 daily reports (including futures prices) to states via GT-type systems. Therefore, CES administrators planning a GT-type system would want to explore this possibility for this state. If AMS provided a state with futures prices, regional prices and the like, then state Extension specialists would need to add interpretational information on market changes and conditions. It would also be desirable to develop a system for providing local prices.

E. Administration of GT

The GT project was added to the work loads of the University of Kentucky and County Extension programs without the benefit of more administrators,

specialists, agents, or staff. In spite of busy schedules, project personnel were highly optimistic and motivated, especially in the beginning stages of the project. As the project progressed, it became more of a strain to juggle schedules to spend sufficient time on GT. In addition, from an overall perspective, technical problems and low usage further reduced staff motivation to work on GT.

In this section and the following sections on specialists and county-level staff, interviews and observations provided evaluators with information on staff duties, role changes, problems, and proposals on how best to implement future computer delivery systems. In terms of an institutional perspective, these next three sections will provide an overview of what worked adequately in the project, what changes had occurred during the test, and what changes should be made for the success of future systems.

Administrators who were responsible for the implementation and operation of GT were the project director and the chairman of the coordinating committee. The project director coordinated the development of design specifications, was responsible for working with vendors and information providers, worked with the university purchasing department in equipment acquisition, and managed hardware and software components of the system. Another major administrative duty was the coordination of university specialists and county level staff. This later task was carried out by both the chairman of the coordinating committee and the project director.

Each of these administrative areas were not small tasks, especially given the fact that GT represented a completely new way of integrating the fields of communications, computers, and Extension information. Because of the novel nature of the system, many important decisions needed to be made to get the system up and running. Though future systems are not likely to require as much emphasis on design specifications as did GT, we strongly recommend that

administrators of future systems have at least a minimum level of understanding of computer hardware and software, the communications field, as well as the relationship of Extension information to the needs of farmers in their state.

In this project, the director spent considerable time coordinating the many companies supplying components of GT. Not only did computer specifications and software linkages need consideration, but also financial limitations dictated using existing university equipment or reasonably priced hardware and software. The end result was a potpourri of different suppliers. Add to this, various agencies, companies, and individuals providing different parts of the database. A final tally showed that fourteen different groups or institutions served GT.

This situation led to a classic case of diffusion of responsibility; that is, vendors or providers disclaimed responsibility for a breakdown, or they blamed it on another link in the system. Consequently, some organizations responded slowly to calls for assistance. The previous recommendation of one vendor (or as few as possible) would minimize this problem.

Another factor contributing to the diffusion of responsibility was the many demands on the project director's time. Out of necessity, he relied on specialists, technicians, and other staff members to serve as liaisons with vendors and information providers. This lack of a single point of contact was a source of confusion for representatives from both the outside organizations and project personnel. Thus, in future systems, the project director needs to be able to allocate enough time so that he/she can perform these duties. Similarly, vendors and information providers should provide a counterpart to the university administrator, raising the chances problems can be handled quickly and competently.

Coordinating Extension specialists included appointing departmental coordinators to organize the input of their department to GT, as well as

chairing monthly GT advisory committee meetings. The monthly meetings included departmental coordinators, administrators, county staff, the evaluation team, and farmers. Positive and negative feedback from these meetings resulted in a number of design and formatting changes. These meetings were informal and resulted in a wide range of free wheeling discussions. However, because they lacked strong guidance, some important issues were never acted upon. Overall, though, these monthly meetings were profitable and would benefit future GT-type systems, especially by including representatives from all staff levels and user groups.

An important change proposed at these meetings was the establishment of a central system of data entry. This was in contrast to each county and university staff member entering their own information. In conjunction, further changes are proposed for the greeting page. This change would entail using the first screen of each session for presenting text messages, oriented toward capsulizing quick-breaking information. Furthermore, this message could reference other frames in the system or more detailed information elsewhere. This "alert page" would be coordinated by an editor at the central entry station. Although these changes were never implemented in this test, they are planned for the second generation GT system at Kentucky.

These design modifications could achieve a number of results that would facilitate administering a GT-type system. First, it would do a better job of highlighting timely information. The central entry station would insure that duplicate or contradictory information would not appear on the system, while concurrently encouraging the development of interdisciplinary information. The editor could also improve the format and display of frames. Moreover, creating a centralized entry system would avoid each staff member having to gain entry into the state computer. Along with the editor, we also recommend that a graphic translator or illustrator collaborate with specialists to visually represent their subject matter.

GT administrators felt this project sensitized them to other uses for computers. Data analysis programs, interactive programs, word processing capabilities, generating mailing lists, recording of client contacts, and maintaining budgetary information were all mentioned as additional ways to use computers. They also felt that, at least in the short run, computerization would not reduce the number of jobs in Extension. They did feel that with increased reliance upon computers, that existing personnel would need some retraining. However, for future hiring, experience and familiarity with computers would invariably become an important consideration.

F. State Specialists

Over the life of the project 67 specialists from 13 departments supplied information to GT. This represents a somewhat inflated figure, however, because most specialists were only marginally involved in the project. In practical terms, an average of three specialists per department actively worked on GT. After the first five months of operation, even these specialists drastically cut the time they spent. Some reasons for this reduction include system unreliability, the small amount of usage, data entry difficulties, and busy schedules. These reasons were influencial in changing specialists' attitudes from very positive to negative. However, even by the end of the test, practically all specialists were optimistic about the future potential of GT.

While these problems seem numerous, they can be handled with some relatively minor adjustments. Ways to make the system more reliable have already been proposed. A centralized system of data entry would solve some difficulties. Problems of low usage and a limited user group were specific to this pilot study. If GT were expanded to a larger system, these problems would disappear. Finally, if a future GT-type system were implemented, some

specialists would need to be assigned specific GT duties, along with the appropriate priority given this function by their administrators.

In this test, two problems with frame presentations became evident - the menu listings were too general and the frame formatting was not standardized. Menu listings should be accurate descriptors of the information contained in the item because this is the only information a user sees when the decision is made as to whether to access a particular frame. In addition, the frame display needs to be standardized to provide the time of the next update for that frame, sources of other related information and references, and the identification of the author of the frame. Referencing the author of the frame generally serves to increase the credibility of the information; however, it may also raise questions of responsibility and liability for the content of the frame. Recommendations could have errors in transmission or could be incorrectly interpreted. Can a specialist or agent be held accountable for the use of information outside of their control? It is beyond the scope of this evaluation to provide a proposal on this policy issue. However, we do feel it is an important topic about which Extension officials need to develop specific guidelines.

Interaction patterns between specialists and agents, and specialists and farmers were not affected to any great extent by GT. When asked to project on these patterns for future systems, specialists were divided as to whether contract with county agents or farmers would increase, decrease, or remain the same. Because of the heavy travel schedules of some specialists, administrators and specialists alike would like to see GT contribute to a reduction in specialist travel. Encouraging specialists to put information on a GT-type system could substitute for some group meetings in reaching certain commodity groups. Another way is for specialists to use GT to deliver their information to county agents. For a GT-type system to influence specialists' travel patterns, farmers would need to be encouraged to develop an information seeking

pattern like the following: to first consult the database, to follow up on references from that information, then consult with the county agent as needed, and lastly to request that the county agent request the assistance of specialists. Ideally, the farmer would acquire most of the needed information in one of the first steps.

G. County Extension Staff

In relation to GT activities, the Extension offices in the two counties were organized quite differently. In one county, the agricultural agent involved the total staff in the operation of GT. In addiiton to his own contributions, the 4-H and home economics agents, as well as the IPM coordinator, made an effort to keep their assigned frames current. The secretary entered information for agents when their schedules would not permit and also performed maintenance functions on the system. Beyond these normal functions, the IPM coordinator worked with Extension specilists in an attempt to make the results of the enumeration of insect pests within the county available to GT users. At the request of the 4-H agent, a community development specialist developed a careers program, which the agent made available to the county school system and local 4-H camps.

In the second county, the agricultural agent carried most all of the load of the GT operation. He took full responsibility for the daily operation of the system. This included entering his own frames, daily mainenance of the computer, and hosting visitors interested in GT. The rest of the staff had limited involvement with the project.

The first county had an easier time incorporating GT into the daily operation of their office. If a GT-type system is to be an Extension information system, it would be desirable to encourage extensive involvement of as many county staff as possible. This type of "team" approach fosters cooperation, which would lead to better utilization of a GT-type system at the county level.

Overall, no drastic role changes occurred for county agents during the test, nor are any expected in future GT-type systems. No computer delivery system can substitute for personal contacts such as farm visits and individualized problem solving. In relation to future systems, the two agents agreed that if more farmers utilized this service, then, in all likelihood, it would stimulate more, rather than fewer, farmer contacts. As it existed in this test, GT complemented existing methods of information delivery at the local level rather than substituted for them.

Although agents did not undergo a complete role transformation, GT did influence some of their other Extension activities. Because the two agricultural agents spent dissimilar amounts of time on the project, GT affected their activities differently. One agent reported that GT activities did not affect his office duties or farm visits to any great extent. In contrast, the other stated that he sent out fewer circular letters and made fewer farm visits because of the project. Since the second agent had a variety of problems which were unique to this test, the experiences of the first agent would be expected to be more typical of the expected influence future GT-type systems will have on county agents.

A positive impact mentioned by both agricultural agents was that the availability of the GT database made it easier to compile material to be disseminated through other channels. In this way, GT supported other mass media methods, as well as individual or group techniques (e.g. radio, workshops, and telephone contacts).

Agents entered information that was either of a general nature, that is, suited to common farming needs, home care, and gardening; or, more specifically directed at the needs of that particular county. In spite of geographical and farming differences, in many cases, the general informaiton entered by both county staff contained very similar content. This suggests that much of the information could be entered on the multi-county or state level. In order to

avoid duplicating equipment and staff functions in every county, we recommend state or strategically located multi-county GT centers. However, with such an approach it is important to preserve the opportunity for county staff to enter county-specific information.

Including additional types of local information needs to be considered for future computer retrieval systems. Farmers could be given the opportunity to advertise services and merchandice over the system. Farmers could submit requests to the local county Extension Office, who in turn, would enter this information on the system. On the other hand, farmers could enter the information themselves, through an "electronic message" system. The second alternative would entail more sophisticated equipment.

In addition, local grain and livestock prices would greatly benefit most farmers, especially small and medium sized farmers. However, this would put Extension in the business of collecting market information, with its ensuing policy and procedural problems. Is this function appropriate for Extension? Who would be responsible for collecting and entering this quantity of information? How detailed can it be with, such things as weight classes, grades, and moisture levels? Who would be responsible for its accuracy? Extension administrators would need to resolve these issues before local prices can be included on a GT system. However, it was evident from the GT test that providing local prices would substantially improve the utility of the system.

H. Staffing

This section includes an indication of the time some staff members spent on this project, prejected time requirements for future systems, and duties some of these staff members would perform.

1. Administrator

a. The project director spent nearly half of his total time on this project, however, the activities and time amounts varied according to the particular stage of the project. In a future system, the

administrative role will require a major portion of a person's time to get the system started, but can be reduced to 10-20% when it is operational.

2. Technical Staffing

a. The Senior Programmer at Agricultural Data Center spent from 20-25% of his time on GT, however, this does not represent an even distribution of time over the life of the project. Rather, he gave all of his attention to GT during short periods of time, while spending little time during other periods.

On the whole, the technical aspect of this project was understaffed. Other institutions might have adequate personnel to manage a computer-based system but most will not. All will need the following types of skills available:

1) Technician - This person would need to have an electronic engineering background, programming skills, along with expertise in communications.

2) Programmer(s) - This person would need technical and programming language skills that coincide with the languages of the unit(s) making up the system.

It is difficult to make specific recommendations concerning programming requirements because staffing and resource needs have to be considered on an ongoing basis so that either indigenious staff can manage hardware or software problems, or the resources are available to handle them on a contract basis.

b. Editor - Although this position did not exist during this test, a GT-type system requires hiring a full-time person who would be responsible for editing specialist information, encouraging interdisciplinary recommendations, and maintaining the system to avoid duplicate, contradictory, or inappropriate information.

c. Graphic Translator - This position was not available in GT; however, a future GT-type system requires a person who would work with specialists to translate their information into graphs, charts, and illustrations.

3. Extension Specialists and Agents

a. Departmental Coordinators - The time they spent on GT varied; during the start up of the system, some spent from 20 to 50% of their time on GT. For the next four months, most spent about 15% of their time on the project, while through the last nine months some spent less than 5%, while many ceased their activities altogether.

For a future system, about one-quarter of the coordinator's time should be allocated to this role. Their duties would include attending staff meetings, developing information for the system, assigning specialists to fill specific informational needs, and encouraging specialists to develop information for the system.

b. Specialists - With the exception of the start-up period, the more active specialists spent up to 15% of their time on GT. For a future system, specialists would need to spend anywhere from 1-10% of their time on a GT system. This would depend on how often they provided information for the system.

c. Agricultural Agent - One agent spent 20-25% of his time on GT, while the other spent 10-15%. The time discrepancy was due to unique problems that only the first agent experienced. If future systems are more reliable, then to develop information and perform normal maintenance duties would require no more than 15% of an agent's time.

I. Policy Issues for Extension

1. Organizational Arrangements

Plans for future microcomputer networks will likely include various organizational arrangements. One alternative is for the delivery system and the information input function to be totally operated by a state Cooperative Extension Service. This would put the responsibility for both the technical and cost aspects of the delivery system, as well as the task of developing and maintaining the database,upon Extension. The state Extension Service could then choose to bear all of the costs, or recover some through user charges, contributions by agribusiness, or support by other public agencies. However, no matter what financial arrangements are worked out, the ultimate responsibility and control of such a system would remain with Extension. In the short run, this may be the only viable alternative if acceptable delivery systems are not forthcoming from the private sector. Like other service functions started by Extension, this service could eventually be encouraged to evolve into a user cooperative or association.

A second possibility is for Extension to concentrate on the development of the information base and leave the delivery system to the private sector. This option is more in line with the strengths of the Extension organization--putting together educational packages rather than hardware and software configurations, but provides Extension little or no control over the critical functions of what, how, and to whom the information is delivered. Comparable arrangements presently exist in the delivery of Extension information by means of farm magazines, newspapers, radio, and TV.

Possibly a more acceptable compromise would be a cooperative venture between public and private interests, so that private firms are encouraged to develop and maintain the hardware and software components of the

delivery network, while Extension contributes subject matter recommendations and interpretations. The system would then expand into new subject and geographical areas as demanded by user groups. This arrangement recognizes the strengths of the private and public sectors and does not attempt to make agricultural specialists out of computer programmers, nor systems design personnel out of subject-matter specialists.

The issue of public or private management is an important consideration for future systems. Generally, administrators in this project perceived that the role of Extension was to test and evaluate the technology and its impact. For future systems, most felt Extension should turn this type of service over to the private sector as soon as possible. However, they felt that it would be desirable to continue to involve Extension personnel, since specialists are able to provide an important contribution. Farmers agree that there is a role for Extension in a service like GT. Two-thirds of the GT farmers indicated that the CES, either alone or jointly with a private company, should provide such a service (Stanford report).

2. Budgetary Impacts

Many concerns have been expressed by Extension administrators as to probable impact of a GT-type system on their budgetary situations. The cost of such a telecommunications system needs to be addressed in terms of the need for additional funds and from the standpoint of savings through improved efficiency. Recognizing that each situation is unique and the state of technology as well as the costs are rapidly changing, information provided here is necessarily general.

First the cost side. It is possible to secure microcomputers with software that could serve as a state computer system for around $20,000, a county or multi-county processor for about $12,000, and user terminals for $400. Therefore, assuming cost-sharing between the state and

counties, and users buying their own terminals, (The Stanford study indicates that about half the farmers are willing to pay for a GT-type system.) a limited system could be put together for under $100,000 in equipment. In addition, there will be telephone charges (leased lines or long distance), plus rotary dials, multiplexers, modems, etc. for linking the units. At this stage, this alternative can be seen as a least-cost option. More capacity can be gained through the use of larger (and usually more expensive) equipment. For example, a minicomputer (rather than a micro) at the state level would allow for simultaneous multiple transmissions, thus allowing for greater capacity to update numerous county or multicounty units in a shorter period of time. In contrast, since microcomputers can only send and receive one message at a time, they would have to update counties in series. A total state update would then be directly related to the number of county computers in the system and, if a large number of counties were involved, slow updates could become a problem.

Since existing personnel will likely be asked to assume most of the additional responsibilities of this new information system, specialized training will be required. In addition, it may be necessary to add technical support staff in such areas as computer programming, systems design, engineering, editing, and translating text messages into graphics. During the GT pilot test it was necessary to purchase commodity future market prices from a private vendor. AMS has since expressed a willingness to provide this same information (though on a less frequent update schedule) at no cost to Extension, thus resulting in considerable savings. As a cost saving measure, it is also desirable to automate as much as possible of the information input procedure.

Kentucky administrators felt that a computer-based delivery system would begin to improve Extension's efficiency after about three years. It was thought that it would take this long to integrate the new system into the Extension organization. The following organizational impacts are anticipated by administrators:

a. Specialists and agents would reach a larger number of people with the same or less effort;

b. Information would be disseminated more quickly;

c. Information would be provided to users in a more convenient manner;

d. Specialist travel would be reduced;

e. Fewer newsletters, bulletins, and other written communication would be needed;

f. Routine functions such as posting the results of diagnostic tests could reduce mailing costs and farmers' waiting time.

From the standpoint of the farmer, it is anticipated that a greater quantity and quality of information would be provided in a more timely and convenient manner that will be utilized in farm decisions resulting in improved productivity and income. Evidence of farmer benefits is reported in the results of the farmer interviews in that 59% said they saved time and 42% saved money by using GT in their farm operations (Stanford report). However, if farmer responses are any indication, Extension administrators should not expect a GT system to free up any appreciable amount of time for county agents. In fact, 87% of GT farmers said that their contact with the agricultural agent either increased or remained the same during the test period.

3. Informational Considerations

The GT project had as its purpose the dissemination of "weather, market, and other agricultural production and management information."

Some individuals have questioned the appropriateness of Extension being the agency to disseminate weather and market information. Though Extension has a long history of providing interpretations of such information for decision-making in agriculture, the reporting of commodity prices and weather forecasts has traditionally been provided by other organizations and agencies. Inasmuch as over 80% of GT use was for weather and market information, while agricultural production information at the state and county levels represented only 12% of the total, one has to question the viability of an Extension-sponsored service like GT if weather and market are not included.

Green Thumb has been referred to as a narrowcasting dissemination system (in contrast to broadcasting) because it was targeted to the specific needs of farmers. This type of system is based on the proposition that by directing information at a particular target audience, there can be more selectivity in content. And yet in an attempt to broaden the test, other Extension information in home economics, 4-H/youth, and community development were included on the GT database. This violated a basic premise of the test in that farm operators were selected as the users, not homemakers, youth, or community leaders. Administrators of future GT-type systems need to decide whether they are developing agricultural information systems or general Extension delivery systems. If it is the latter, exactly how to direct the information to the different Extension audiences needs consideration.

In addition, some farmers were requesting information that was beyond the scope of the test. These included requests for information

on such topics as changes in the money market, stockmarket, bond market, precious metals, and international trade, as well as futures market information on a "real-time" basis for purposes of speculation. Decisions will have to be made as to whether systems will try to be all things to all people, or will stay within clearly defined boundaries.

During GT there surfaced two schools of thought concerning the type of Extension information that was appropriate for inclusion in a GT-type system. The first argues that only quick-breaking, alerts belong on this type of delivery system. By its very nature, this communication system is designed to deliver concise and timely messages that change frequently. Currancy is seen as an important component because such information is very perishable. Since this approach could be seen as cutting into the market of such mass media systems as radio, TV, and newspaper, criticism can be expected. The Kentucky Broadcasters Association saw GT as an intrusion of the public sector into electronic farm news service. GT was described as, "Just another 'expensive' local service provided by your government in direct competition to commercial braodcasting" (KBA Newsletter, May, 1980).

However, in reality only a small portion of Extension information fits the "currancy" criteria; that is, the majority does not become out-of-date so quickly. Recognizing this fact, one could justify the use of a GT system merely to provide another method of delivering Extension information (whether perishable or not) that might eventually reduce the need for printed bulletins and newsletters. Given the increased costs of printing and mailing, this could be an important efficiency consideration.

The nature of Extension's program is that it provides an educational service, not merely information dissemination. The provision of information is an important part of the educational process, but is not seen as adequate in itself. The mission of Extension is considerably different than that of AMS, NWS, or the mass media in this regard. Therefore, Extension needs to consider how a computer-based information system contributes to the educational process. As evidenced by the following quote, Extension could learn from the experiences of higher education in the use of computer-assisted instruction (CAI).

> "We were all a little optimistic about how CAI would solve all of the problems of education... We were forgetting the social aspects of the educational environment, the need to combine personal and social contact with reinforcement from the machine. It's a question of balance that we are just now beginning to understand" (Peters, 1976:42).

Another informational consideration is the magnitude of the database. GT contained approximately 450 different informational items, 80% of which were entered by specialists and agents. Some felt that this was too large a number of items for providers to maintain adequately, and at the same time was more than what farmers would use. Specialists indicated that they would prefer to do a better job with a limited number of items.

A GT-system is unique in that it can make available to the user information from many sources. GT utilized various information providers, some were public agencies (NWS and AMS), one was private (AQS), and others were personnel internal to Kentucky Extension. However, no matter where the information originated, users held

Kentucky CES responsible for its accurateness and currentness. As a result, the sponsoring organization or agency is held accountable for factors over which, at times, it has little or no control. This will become a critical issue when the user is paying for the service.

4. Equity of Access

In the introduction of a new technology such as GT, there is concern over who will be the beneficiaries of the program. Will it serve primarily large, upper income farmers, or will limited resource producers also share in the benefits? Evidence from this test has demonstrated that farms over 1,000 acres used the information more than those of fewer acres, however, on farms of less than 1,000 acres, the proportion of "high" users was fairly constant over the full range of farms. There were no significant differences in use by the different levels of farm sales. Interestingly, the top farm sales category ($100,000 and over) actually had the lowest percentage of "high" users.

In terms of the characteristics of the farm operator, there were more "high" users among farmers with a high school education or less than those with college training. Nor were farmers with a high family income the heaviest users. In fact, use was found to be inversely related to income. The lowest income category (under $15,000) had the greatest percentage of "high" users and this percentage declined as income increased. However, one must take into consideration that the highest income category contained many highly educated individuals that had full-time off-farm employment and were not frequent GT users.

GT use was shown to be more related to the commitment of the individual to the farm operation, than to different indicators of the relative magnitude of the farm. This commitment is indicated by the proportion of family income being derived from the farm, and whether the operator or spouse were employed off the farm. Because the GT test included users of all farm sizes, one can conclude that farms of all sizes did share in the benefits of the program.

A related concern has to do with the probable impact of a GT information system on the structure of agriculture. Because such an information system was found to be useful to all farms of different sizes and income levels, a GT-type system would not be seen as causing major changes in the size and numbers of farms.

Another potential barrier to participation of some individuals has to do with the amount of user charges anticipated in future systems. Every system will be unique in this regard; however, because the cost of available user equipment is likely to be low (about $400 for a terminal), user cost is not seen as a serious inhibiting factor to participation. At the same time, other farmers could choose to access the same database by means of more costly and sophisticated multiple-use microcomputers. Therefore, a system can be flexible enough to allow for various alternatives.

In order to preserve a high degree of user control and to keep the cost to a minimum, a GT-type information system could eventually be user-owned and operated through a cooperative or an association.

J. Final Conclusion

While the computer industry will continue to produce more sophisticated equipment, the basic technology of computers has progressed to the point that a GT-type system can be constructed in a variety of ways to deliver information on a reliable basis. In addition, most hardware purchased at this time has the capacity for expansion and upgrading. This increases the possible range of functions they can perform either within a GT-type system or for different Extension tasks.

To illustrate their flexibility, lets examine two possible alternatives following the introduction of a computer based delivery system. On the one hand, the farmer demand for a GT-type system could accelerate at a phenomenal rate, thereby creating the need for bigger computers with expanded capacity. To satisfy this need, a larger state computer could be purchased, leaving the former state computer free to be converted into a county/multi-county unit. On the other hand, let's say that the farmer demand for a computer-based information delivery system never materializes. Then the computer network could be dismantled and used for other Extension functions, such as research, word processing, and record keeping. This flexibility provides assurrances that once computers are acquired they can be modified to service the changing needs of Extension.

With GT, the computer age has been introduced to agriculture. An inticing aspect of its arrival is the relatively low cost for both the sponsoring agency and the farmer. From an organizational perspective, five factors may serve to keep the costs reasonable: 1) low initial hardware costs for dump-and-disconnect systems like GT, 2) the flexibility of the equipment, 3) the ability to utilize public sources of information (e.g., NWS, AMS), the potential for cost sharing within the public sector (federal, state, and county levels) and between the public and private sectors, and 5) charging a modest user fee to offset some of the overhead costs.

Farmers also would not be risking very much in terms of costs, time, or committment. In fact, it seems that the present demand for information far overshadows the small risks involved. Compared to other farming expenditures (e.g., $50,000 for a tractor), $400 for a data terminal is a bargain. Even the purchase of a microcomputer for, say, $3,000, may still be seen as relatively inexpensive. A microcomputer would also give the farmer the added capability for farm recordkeeping and farm analysis at home.

As in any new technology, it is safer to recommend a wait-and-see attitude so as to allow others to take the early risks. However, as stated throughout, most of the problems in the GT test were technical or organizational and, with some effort, can be resolved. The system as it was conceived possessed the potential of accomplishing what it set out to do - to deliver weather, market, and other agricultural production and market information to farmers. Therefore, we advocate that Extension move ahead with the implementation of this type of delivery system. At the same time, however, we recommend continued research on the impacts of GT-type systems and methods for improvement. In summation, computer based informational delivery systems like GT would give CES an added opportunity to disseminate research, farming information, and educational information on a timely basis to a variety of farmers and at an affordable price.

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APPENDIX A

QUESTIONNAIRE

Name _____

WEATHER

1. How important is weather information to the operation of your farm? (check one)
   ___ very important
   ___ somewhat important
   ___ of little importance
   ___ not important

2. Where do you presently obtain weather information? (estimate percent obtained from each source) List names of above sources
   ____% radio _____
   ____% T.V. _____
   ____% newspaper _____
   ____% other _____

3. What types of weather information do you use (for example: daily forecasts, 30 day outlook, relative humidity)?

   _____

   _____

   _____

4. Do you presently receive all of the weather information you need?
   ____ yes ____ no

   If no: What other information would you like to receive?

   _____

   _____

   _____

5. Is the weather information you get accurate enough?
   ____ yes ____ no

6. Is the weather information up to date? ____ yes ____ no

7. What problems have you had in getting adequate weather information?

_____

_____

_____

8. Do you receive the National Weather Service Agricultural Advisory?
____ yes ____ no

MARKETING

1. Indicate how you use marketing information in your farming operation. For each category, indicate the importance of marketing information in making these farm decisions. (circle one number)

	Low				High
enterprise selection	1	2	3	4	5
determining the level of production	1	2	3	4	5
determining when to sell	1	2	3	4	5
determining where to sell	1	2	3	4	5
determining when to buy inputs	1	2	3	4	5
farm expansion	1	2	3	4	5
other (list) _____	1	2	3	4	5

2. What types of marketing information do you presently use? (check the ones you use)

____ futures prices
____ cash commodity prices
____ input prices
____ volume of sales
____ inventory statistics
____ market trends
____ outlook information
____ cash contract prices
____ other (list) _____

3. In addition to those checked above, list other types of marketing information that you would like to receive.

_____ _____

_____ _____

_____ _____

4. Where do you presently obtain marketing information?
(estimate percent obtained from each source)

____ % radio
____ % T.V.
____ % newspaper
____ % Extension Service
____ % U.S.D.A.
____ % buyers (elevator, stockyards, etc.)
____ % other farmers
____ % market news service (Federal/State)
____ % co-ops
____ % credit institutions
____ % farm magazines
____ % commercial agencies (Doane, Leslie Reports, Kiplinger Report)
____ % other (list) _____

5. What are the problems with the marketing information you currently receive?

____ information is not accurate
____ information is not up-to-date
____ difficult to understand
____ not localized enough
____ conflicting reports
____ not often enough
____ not enough interpretation
____ other (list) _____

6. During 1979 did you trade any futures contracts for commodities you use or produce in your farming operation? ____ yes ____ no

If yes: a. Did you long hedge? ____ yes ____ no
b. Did you short hedge? ____ yes ____ no
c. Did you speculate? ____ yes ____ no
d. For what commodities did you use the futures market?

_____

_____

_____

If no: (a) Did you follow futures prices at the beginning of your 1979 crop/livestock year? ____ yes ____ no
(b) Did you follow prices when making marketing (selling) decisions? ____ yes ____ no

(c) What are the reasons you have not bought or sold futures contracts? (circle as many as appropriate)

1. Not acquainted with how future market operates.
2. Lack of adequate capital.
3. Size of farming operation too small to warrant using futures contracts.
4. Futures market too risky.
5. Don't approve of the futures market
6. Don't have time to follow the futures market closely.
7. May local basis (cash price--futures) is too unstable.
8. Fear of being "locked in" by limit moves in futures prices.
9. The past year offered no opportunities worth trading.
10. Other (specify)

_____

_____

_____

7. Did you keep tract of your "local basis" during 1979?
   ____ yes ____ no

8. During 1979 did you enter into any type of forward contract to sell (excluding futures)?

   ____ grain crops (including soybeans)
   ____ livestock
   ____ other _____

9. What market information do you want to receive on Green Thumb?

_____

_____

_____

_____

BACKGROUND INFORMATION

1. Livestock	Number Presently	Value of Sales in 1979
Beef (cows and bulls)	_____	_____
Beef (feeder cattle)	_____	_____
Hogs and pigs	_____	_____
Milk cows (Dairy cattle)	_____	_____
Bull and calves (Dairy cattle)	_____	_____
Dairy products	XXXXXXXXX	_____
Poultry	_____	_____
Horses	_____	_____
Sheep	_____	_____
Other _____	_____	_____

2. Crops		
Corn	_____ Acres	_____
Soybeans	_____ Acres	_____
Wheat	_____ Acres	_____
Tobacco	_____ Acres	_____
Hay	_____ Acres	_____
Pasture	_____ Acres	_____
Other _____	_____ Acres	_____

3. Farm size _____ own _____ rent

4. Organization of farm (circle one)
   a. individual or family
   b. partnership
   c. corporation

5. How many years have you farmed? _____ years

6. Did you work off the farm in 1979? ____ yes ____ no
   If yes: How many days? _____

7. Did your spouse work off the farm in 1979? ____ yes ____ no
   If yes: How many days? _____

8. What was your family income (before taxes) in 1979? (circle one)

   a. Less than $3,000
   b. $3,000 to $4,999
   c. $5,000 to $9,999
   d. $10,000 to $14,999
   e. $15,000 to $19,999
   f. $20,000 to $24,999
   g. $25,000 to $29,999
   h. $30,000 to $34,999
   i. $35,000 or more

9. What percent of your family income comes from non-farm sources? _____%.

10. Do you have any children living at home? ____ yes ____ no
    If yes: what are their ages? _____

11. Are any of your children living at home employed off the farm?
    ____ yes ____ no

12. Your age? _____ years

13. How far did you go in school? (circle one)

    a. never attended school
    b. some grade school
    c. completed grade school
    d. some high school
    e. completed high school
    f. some college (or vocational training)
    g. completed college
    h. some graduate work
    i. a graduate degree

14. Present marital status? (circle one)

    a. never married
    b. married
    c. divorced
    d. separated
    e. widowed

15. Have you used information from the Extension Service in the past year?

____ yes ____ no

16. Do you raise a vegetable garden? ____ yes ____ no

17. Does anyone in your family sew? ____ yes _____ no

18. Do you preserve food at home
    a. by freezing? ____ yes ____ no
    b. by canning? ____ yes ____ no

EXPERIENCE WITH GREEN THUMB

1. How useful has the following information been to you and your family? (circle answer)

1 = very useful, 2 = somewhat useful, 3 = little use, 4 = don't use				
Weather maps	1	2	3	4
Weather advisories	1	2	3	4
Futures prices	1	2	3	4
Cash prices	1	2	3	4
Market outlook	1	2	3	4
County news	1	2	3	4
Pest management	1	2	3	4
4-H information	1	2	3	4
Home economics information	1	2	3	4
Resource Development	1	2	3	4
Ag. economics	1	2	3	4
Ag. engineering	1	2	3	4
Agronomy	1	2	3	4
Animal sciences	1	2	3	4
Entomology	1	2	3	4
Forestry	1	2	3	4
Horticulture	1	2	3	4
Plant diseases	1	2	3	4
Rural Sociology	1	2	3	4

2. List problems you have had with Green Thumb.

_____

_____

_____

3. List additional information that you would like to have on Green Thumb.

_____

_____

_____

_____

4. How well have you been able to understand the information on Green Thumb? (circle answer)

1 = all,	2 = most,	3 = some,	4 = none
Weather maps	1	2	3	4
Weather advisories	1	2	3	4
Futures prices	1	2	3	4
Cash prices	1	2	3	4
Written information	1	2	3	4

APPENDIX B

QUESTIONNAIRE FOR EXTENSION SPECIALIST

Paul D. Warner
Frank Clearfield

University of Kentucky

ROLE

1. Do you serve as a departmental coordinator for Green Thumb?

   If not, what is your assignment?

2. Could you describe your Green Thumb related duties?

3. Describe your initial experiences with Green Thumb, e.g., how you heard about it? How you were selected to work on the project, etc.

4a. What was your initial reaction to the GTB project?

4b. Has your attitude toward Green Thumb changed since the beginning of the project? How?

DEPARTMENTAL STAFFING

5. How many specialists and/or staff members in your department are working on Green Thumb?

6. Who are they?

7. What does each of them do?

8. Have there been any problems getting members of your department interested and involved with Green Thumb? If so, what is the nature of the problem(s)?

9a. What was the initial reaction of other specialists/staff members working with the Green Thumb

9b. Has their attitude toward GT changed since the beginning of the project? How?

10a. Did you work with personnel from another department to prepare (o display) information on Green Thumb? If so, how?

10b. Do you see any benefit in working across department lines for the preparation of frames? If so, what are they?

10c. Do you see any disadvantages? If so what are they?

11a. How did departmental/nondepartmental personnel not directly involved with Green Thumb react to Green Thumb?

11b. How did departmental/nondepartmental personnel not directly involved with Green Thumb use Green Thumb?

12. Can Green Thumb be added to your department's work load without adding more staff?

    If no, how much more and/or what type of assistance is needed?

DEPARTMENTAL FRAME ASSIGNMENTS AND UPDATES

13. Which frame numbers have been assigned to your department?

14. Which frames has your department prepared on a regular basis?

15a. How have you organized your department's entries?

15b. Are frames assigned to different specialists?

15c. What basis did you use to assign frames to different specialists?

15d. Do you break down the frames according to different topics within your department?

16. How often do you update different frames?

1. Frame _____
   Average Update _____
   Optimal Update _____

2. Frame _____
   Average Update _____
   Optimal Update _____

3. Frame _____
   Average Update _____
   Optimal Update _____

4. Frame _____
   Average Update _____
   Optimal Update _____

5. Frame _____
   Average Update _____
   Optimal Update _____

6. Frame _____
   Average Update _____
   Optimal Update _____

7. Frame _____
   Average Update _____
   Optimal Update _____

8. Frame _____
   Average Update _____
   Optimal Update _____

9. Frame _____
   Average Update _____
   Optimal Update _____

10. Frame _____
    Average Update _____
    Optimal Update _____

17. What information changes have you made during the calendar year/farm cycle for each frame?

1. Frame _____
2. Frame _____
3. Frame _____
4. Frame _____
5. Frame _____
6. Frame _____
7. Frame _____
8. Frame _____
9. Frame _____
10. Frame _____

18. When you add new frames or change the overall content of existing frames, do you change frame headings as well?

19. Do you normally inform anyone of additions or changes in your frames?

    If yes, who and how?

20. Can you suggest the clearest and most efficient way for informing users of frame changes or frame additions?

21. Have you been affected by hardware/software problems? e.g. busy telephone lines, inadequate instructions for putting frames on Green Thumb/calling up frames, inaccessible terminals, data base busy, etc.

    If so, describe these problems.

FRAME CONTENT AND DISPLAY

22. Was the information you put on the system developed specifically for Green Thumb? Did it have other uses as well? What were those uses?

23. Is there any information that GT farmers get on GT that other farmer's do not receive through other sources from your department?

24. How do you display your information? (Text, graphics, charts, every other line, every third line, etc.)

25a. Have you changed the way you format the information since the beginning of the project?

25b. If yes, how have you changed it?

25c. In what other ways could the format be changed?

26. How much time elapses before the information you put on each frame is out-dated?

Frame # _____

a. 15 minutes _____
b. 1 hour _____
c. 4 hours _____
d. 12 hours _____
e. 24 hours _____
f. 3 days _____
g. 1 week _____
h. 1 month _____
i. 3 months _____
j. 6 months _____
k. 1 year _____

Frame # _____

a. 15 minutes _____
b. 1 hour _____
c. 4 hours _____
d. 12 hours _____
e. 24 hours _____
f. 3 days _____
g. 1 week _____
h. 1 month _____
i. 3 months _____
j. 6 months _____
k. 1 year _____

Frame # _____

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i. 3 months _____
j. 6 months _____
k. 1 year _____

27. Do your frames each stand alone as an informational source or do they comprise part of a larger educational package? If so, what larger package?

28a Do you think it is possible to teach part of your subject through a series of frames which progress from general to more specific types of information.

28b By changing this same series of frames from week to week (month to month), do you think more of your subject could be taught effectively and systematically through a Green Thumb-type system?

29a Given your subject matter, do you feel the information you provide is appropriate for a Green Thumb-type system?

Why or why not?

29b If not, what is the most appropriate form?

TIME ALLOTTED TO GREEN THUMB

30. What have been the primary factors affecting the extent of your input into Green Thumb as an information delivery system?

31. Does the number of people using the Green Thumb system affect the amount of time and energy you spend on the project? If yes, how?

32. Could you estimate an average amount of time per week that you spend on Green Thumb? Did this change over time? How did preparation time vary per frame?

33. Can you break down the time you spend on Green Thumb by the time it takes to pull the information together, general office work or other activities e.g. in-house meetings, travel to the counties, etc.

34. Has Green Thumb changed your work routine? How?

35. Have you reported the time you spend on Green Thumb on the KEMIS system?

Under Objective 81?

36a If you were assigned to a state-wide future Green Thumb system how much time per week would you expect to spend on it?

36b How much time would you prefer spending on it?

37. Have you been to professional meetings or presented papers in connection with Green Thumb? Describe any similar activity. Do you intend to pursue any such activity?

38. Do you think a Green Thumb system has a place in the future of the Cooperative Extension Service delivery system? How could it be utilized?

39. What do you see as the advantages and disadvantages of the Green Thumb system when compared with other delivery methods?

APPENDIX C

COOPERATIVE AGREEMENT
Between
Cooperative Extension Service
University of Kentucky
and
Participants of the Green Thumb Project

The Cooperative Extension Service agrees:

1. To conduct a pilot test of the Green Thumb Project to provide weather, market and other agricultural information to 100 farmers in Shelby County.

2. To provide the necessary equipment at no cost to the participant. All equipment will remain the property of the Extension Service and will be returned to Extension at the end of the test.

3. To provide training necessary for operation of the system.

4. To provide as current and accurate information as is possible.

5. That any information collected on the patterns of use of participants or other evaluation information will be used solely for the evaluation of the project and will be used only in aggregate form without identifying individual participants.

Farmers selected for the project agree:

1. To participate in the test for a period of 14 months.

2. To allow the Extension Service to monitor the use patterns of the participants during the period of the test.

3. To participate in an evaluation of the project, to include an interview at the beginning and end of the test.

This agreement can be voided at any time by either party of the agreement.

Date: _____

_____ _____

County Extension Agent for Agriculture
Kentucky Cooperative Extension Service

Participant